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ABSTRACT

Prepared as a basis for environmental education curriculum development, this manual establishes guidelines for curriculum decision-making in any school, community, region or nation. In addition, the current status of environmental education is analyzed, and the character of contemporary curricula and materials development efforts is summarized. Emphasized is the need to establish programs which reach toward involving citizens in addressing environmental problems. A flow chart of the curriculum-implementation-evaluation process serves as a reference for applying the procedures and guidelines presented. These include curriculum patterns, decision-making criteria, multidisciplinary instructional models, and guidelines for teacher preparation. Appended are: (1) model activities based on the described infusion process and curriculum development goals; and (2) a bibliography of materials, programs and issues related to the positions outlined. (Author/WB)

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United Nations Educational, Scientific and Cultural Organization

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Strategies for Developing an Environmental Education Curriculum

A Discussion Guide for Unesco Training Workshops on Environmental Education

1980

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STRATEGIES FOR DEVELOPING AN ENVIRONMENTAL EDUCATION CURRICULUM

A DISCUSSION GUIDE FOR UNESCO TRAINING WORKSHOPS ON ENVIRONMENTAL EDUCATION

This document has been prepared under Unesco contract No. 206.517 by Dr. Harold R. Hungerford, Professor of Environmental Education, Department of Curriculum, Instruction, and Media, Southern Illinois University, Carbondale, Illinois, and by Dr. Robert Ben Peyton, Assistant Professor, Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan.

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PREFACE

The general purpose of this document is not to defend the need for world wide environmental education, but rather to suggest some means by which we can get down to the business of its implementation. However, it may be helpful to address the philosophical nature of environmental education (EE) contained herein.

For purposes of this document the superordinate goal of environmental education is accepted as the following.[1]

> ... to aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated citizens who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment.

The above statement suggests two important implications which need to be further explicated here. First, the goal implies that EE must develop problem solvers and thus should itself utilize a problem solving approach. Secondly, it is important to note that EE is concerned with both a quality of human life and a quality environment.

A review of the goal level statements presented in Chapter III, and the sample lessons provided in Appendix A should indicate the problem solving nature of an effective EE curriculum. Goal levels III and IV clearly mandate that EE curricula provide students with experiences in environmental problem solving skills such as problem identification, values clarification, issue investigation and evaluation, and the identification, sample lessons included in Appendix A illustrate how such experiences may be designed.

---

[1] This goal is further developed and operationalized as goal levels in Chapter III in this document.

It is not sufficient to tell students about ecology, or to present them with an awareness that environmental problems exist. The curriculum must take them beyond these levels as implied by Goal Levels III and IV. Students should experience an EE curriculum which allows them to discover how they interact with the environment themselves. They should assess their own impact on the environment. Further, they must be allowed to develop investigative, evaluative and action skills by using these processes as well as learning about them.

To provide these experiences, curriculum developers must have access to a diversity of case studies which present environmental problems at the individual, local, and regional as well as national or international levels. Some steps which may facilitate this process are described in the Chapter III section entitled "Procedural Guidelines and Considerations for Curriculum Development."

In addition to these environmental problem solving skills, curriculum developers must also be congnizant of the more generic and basic mental processes associated with problem solving. These basic skills should be incorporated into EE curricula just as they have been increasingly utilized by other disciplines including the biological, physical and social sciences. For example, EE curricula should provide opportunities to improve skills such as observing, data collecting and analyzing, hypothesizing, inferring, predicting, etc. Although such basic skills are no less important than the more specific environmentally related processes, no attempt has been curriculum, other than to include such skills in some of the sample lessons in Appendix A. It is assumed that curriculum developers will be familiar with the processes involved in teaching basic problem solving skills such as these. However, for more discussion of this topic the reader is urged to consult some of the many recent sources in science education curriculum development.

Citizens must be trained who can and will apply problem solving skills to the remediation of those problems we face today, and to the planning necessary to avoid environmental problems of the future. However, environmental and other problem solving skills cannot be taught through didactic lecture methods. EE curricula must be developed which provide opportunities for students to have experiences with all dimensions of problem solving. Without this component, the goal of EE cannot possibly be achieved.

The second implication of the goal statement concerns what may seem at first to be a conflict of interests between quality of life and quality of environment. Indeed, there is and will continue to be some conflict and this will necessitate some compromise. However, quality of life does not preclude a quality environment or vice versa. Rather, each is a prerequisite of the other. It would be hard to imagine an acceptable quality of life without an acceptable environmental quality. On the other hand, no environment suffers more than that of a starving, poverty stricken human society which must exploit all of its resources to achieve short term survival.

One of the most crucial issues which affects all countries, but most directly affects the developing countries is the need to produce and distribute adequate supplies of food to the world population. Often attempts to increase food production involve insufficient or inappropriately applied agrotechnology. The result is a bad situation made worse. Removal of forests whether for agricultural, firewood, or lumber purposes, allows a loss of nutrients through leaching. Widespread erosion is especially severe where high and rising population pressures combine with primitive technology to cause deforestation of mountain slopes.

The occurrence of floods in the Indus plain of Pakistan increased from the 1940's to the late 1960's due to a filling in of river channels by silt from denuded slopes of the Himalayas. A $600 million reservoir in Pakistan (Mangla) began operations in 1967 with the expectation that it would last for 100 years. At the present rate of siltation, the reservoir is now expected to last no more than 50 to 75 years. Erosion and flooding are increasing in India, Thailand, the Philippines, Indonesia, Malaysia, East Africa, and in much of the Andean region of Latin America.

There are other problems that can arise from man's misuse of the land. Almost 7% of the land in the tropics contains a soil type which oxidizes and becomes unarable when cleared of vegetation (laterization). Over 6% of the earth's surface now classified as desert is attributable to man's activities - many of them agricultural. Water logging and salinity of the soil is being experienced where irrigation is being increasingly used for crop production in the Nile Valley, the Indus plain, China, Peru and northeast Brazil. These and other examples of environmental destruction cut back the carrying capactiy of the land and make the food and economic situations even worse.

All of this is not even representative of the scope of the environmental problems brought about by man's uneducated attempts to manipulate his environment. However, it should suffice to indicate that the message

Developing countries need not fear that a commitment to EE would conflict with the desire to upgrade the quality of human life. Nor do developed countries have to return to the "stone age" in order to achieve the goals of EE. Indeed, the development of the world's resources in order to maintain a desirable quality of life is only possible through effective environmental education efforts. For example, a shortage of energy to support man's activities may be better remediated by a more intelligent and efficient use of our present resources, than by a blind search to exploit even more energy reserves. Effective environmental education progammes will be necessary if world inhabitants are to understand the need for, develop, and implement the necessary efficient energy technologies. The consequences of failure to achieve the goals of EE are clearly forecast. One has merely to review the tragic poisoning of the Love Canal in America, global acid rainfall, the disappointment of projects such as the Aswan Dam in Egypt, a depletion of our ocean fisheries, oil polluted beaches, international conflict over energy reserves - the list is endless and the message clear. Mankind must attend to the health of the environment.

Developing countries have a right to pursue a quality of life which they observe in their more affluent neighbors. Developed countries have a right to strive for the maintenance of a quality life. However, their gains - if any - will be short lived if they fail to learn from the expensive and sometimes tragic experiences of environmental destruction. We must all plan and make decisions in accordance with the natural laws which govern our planet. Past experience shows us that to ignore these laws is not only foolish - it is disastrous. Perhaps that is the warning intended

A man said to the universe:
"Sir, I exist!"
"However", replied the universe,
"The fact has not created in me
A sense of obligation."[1]

---

[1] Quote from Stephen Crane which appears in You Can See Forever, C.R. Gibson Co., Norwalk, Connecticut, 1977.

CHAPTER I

INTRODUCTION

> National reports . . . testify to the significant advances made by a number of countries towards implementing environmental education programmes both inside and outside the school system. Important as these efforts and achievements may be . . . there are still gaps and shortcomings. Less seems to have been achieved at the secondary level than at the primary level in schools both quantitatively and in terms of innovation. Little has been done for training out-of-school educators or in-service teachers in environmental matters. There are still far too few trained for the teaching of ecology or capable of effective participation in a multidisciplinary approach. Last, but most important, there still appears to be a considerable need for developing or refining overall environmental education strategies in all forms and at all levels of education.
>
> The Tbilisi Declaration,
> Connect, vol. III, no. 1,
> January 1978.

This document is sponsored by the Unesco-UNEP International Environmental Education Programme in response to needs identified by the Intergovernmental Conference on Environmental Education, Tbilisi, USSR, 1977. It has been prepared primarily to serve as a basis for curriculum development in environmental education (EE). It does not propose a specific curriculum for EE but, instead, establishes a set of guidelines which are valid for curriculum decision-making in any school, community, region, or nation. Specifically, this document:

(1) analyses the present status of environmental education and synthesizes a statement as to the character of current curricula and and materials development efforts.

(2) presents strategies and guidelines for curriculum and materials development in environmental education at primary, secondary and tertiary (teacher education) levels.

The format for curriculum development used in this document is directed toward the institutional level (i.e., the university or public school system), but it is intended to apply generically to curriculum development at any level (local, regional, or national). The application of specific strategies may vary considerably with the nature and the scope of a particular project. However, the guidelines for EE curriculum decision making presented herein should be largely adhered to by any development team if the completed curriculum is to achieve internationally-accepted goals for environmental education.

Chapter III of this document is particularly important for any EE curriculum development effort. Specifically, Chapter III represents a synthesis of curriculum development tasks, each of which contributes to the overall project. Critical Chapter III components include available curriculum patterns for use in EE, criteria for decision-making in curriculum development, instructional models which demonstrate how specific instructional designs attempt to meet appropriate goals in a multidisciplinary (infused) curriculum, procedural guidelines to be followed in curriculum development efforts, curriculum implementation, curriculum evaluation, and guidelines for teacher preparation in EE.

A flow chart of the entire curriculum/implementation/evaluation process is presented in Chapter IV. The curriculum developer may wish to use this flow chart as a reference while studying or applying principles and guidelines presented in Chapter III. Such a strategy would provide a framework within which a sound developmental syntax could be maintained.

CHAPTER II

PATTERNS IN ENVIRONMENTAL EDUCATION

Environmental education (EE) as an entity with the same name is of fairly recent origin. Its roots, however, extend back in time to that moment when man first envisioned an interrelationship between himself and the biosphere which resulted in an evaluation of his role in the maintenance or deterioration of that environment. Exactly when this took place and the context of this interaction are, of course, uncertainties. However, the historic concerns for the interactions of man with the environment are many and various. They appear in the folklore of numerous tribes or races. They appear as biblical references and in other early writings. And, as man began to expand and record his history, references to interrelationships with the environment became more numerous.

More recently - with respect to man's history - the roots of EE can be traced back to the conservation movement(s) although in many dimensions and for many reasons the conservationist of yesterday and the environmentalist of today yield different images. Albeit differences exist between conservationism and environmentalism, the conservation movement(s) throughout the world go back centuries in time. Various movements across various cultures came and went as societies evolved in their perspectives concerning the environment and the use of available natural resources.

In North America, the beginnings of the conservation movement have been traced back to 1626 when an ordinance was passed in Plymouth Colony controlling the cutting and sale of timber on Colony lands.[1] From this point onward, a number of serious attempts were made to develop a philosophy of what constituted an acceptable man-environment relationship. Numerous points of view arose, among them the divergent perspectives allied with unlimited use of resources and man's responsibility to maintain the integrity of natural ecological systems.

In the schools, the roots of environmental education can be traced back to the didactic literature printed for use in schools dominated by religious groups. Texts moralized the virtues of certain kinds of human behavior toward the environment as well as providing an attitudinal set toward both living and nonliving resources.

The didactic literature period was followed by what has come to be called the Nature Study movement, a conservation oriented science education which was characterized by nature observations and a respect for natural systems. This movement lasted in the USA until about 1930.

Formal conservation education had its beginnings after the turn of the Twentieth Century but didn't gain momentum until the 1930's (USA). Conservation education lost its momentum late in the 1940's and there was little activity in any similar dimension (with the exception of outdoor education programs) until the 70's. Due to a myriad of issues and problems relating to natural ecosystems and man's communities, environmental education - as a distinct entity - arrived on the world scene. It was at this time that the world community began to focus on a concerted effort to bring EE into world-prominence through the auspices of the United Nations.

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[1] Nash, R. The American Environment: Readings in the History of Conservation. Reading, Mass. Addison-Wesley, 1968.

In 1975 a questionnaire entitled, "Assessment of Resources for Environmental Education: Needs and Priorities for Member States" was distributed by the environmental education section of UNESCO to 136 Member States. The aim of this research was to furnish specialists and decision-makers in EE with a valid and viable base of information on which future action could be based, taking into consideration the principle insufficiencies affecting such an education at the world and regional levels.[1]

A major component of the UNESCO questionnaire dealt with trends in environmental education programs. A number of extremely significant findings were generalized from this study.[2] Among these were:

> (1) World educational programs are insufficient in number or in scope to make environmental education a national preoccupation. This insufficiency was particularly evident in developing nations.
>
> (2) There exists a persistent lack of truly interdisciplinary approaches for EE programs. Educational programs based on real problems and a functional logic aimed at their solution, have not been developed, in a general manner, in any of the countries studied.
>
> (3) A definite lack of concrete problem-solving approaches exists. This condition tends to isolate the EE program from the surrounding community, resulting in only limited efficiency.
>
> (4) There exists a tendency (in EE programs) to reduce the environment to its natural aspects. This tends to preclude the consideration of social perspectives and makes the comprehension of complex phenomena and problems a difficult task.

By and large, these findings were further documented in other research studies. Many of the same problems and issues were identified and reported for the United States by Childress and Wert in 1976.[3] Contributing to the

---

1. Needs and Priorities in Environmental Education: An International Survey, UNESCO/ENVED 6. (Paris, UNESCO) August 1977, p. 5.

2. Ibid., p. 11-12 (Paraphrased from the original translation).

3. Childress, R.B. and Wert, J. "Challenges for Environmental Education Planners." The Journal of Environmental Education. (USA) vol. 7, no. 4, Summer 1976, p. 2-6.

persistent presence of problems, at a time of emerging interest in EE, was the sometimes silent and sometimes vocal debate surrounding the philosophical parameters of EE per se. These varying perspectives of what constituted EE led to a multitude of programs revolving around traditional conservation education, nature interpretation, outdoor education, outdoor recreation, and others. There appeared to be little agreement as to the substantive structure of EE and this lack of concensus was further promulgated by individuals who were attempting to maintain quasi-environmental programs for a variety of reasons.

During this period of indecision and confusion in EE, UNESCO in cooperation with the United Nations Environmental Program (UNEP) was attempting to bring the world community together and work toward a comprehensive strategy within which environmental needs could be met. A number of regional and world conferences were held, each contributing to a philosophy and a body of knowledge concerning world needs and a perspective of EE. These meetings led, eventually, to the world's first Intergovernmental Conference on Environmental Education, organized by UNESCO in cooperation with UNEP. This conference was convened in Tbilisi, Georgia (USSR) in October of 1977. This conference was attended by 66 Member States and observers from two non-Member States.

The Tbilisi Conference resulted in unanimous agreement concerning the important role of environmental education in the preservation and improvement of the world's environment. From this conference came a document (the Tbilisi Declaration) which thoroughly delineates a substantive structure for EE and recommends policies and strategies to be followed world-wide.[1] This document, without a doubt, is one of the most important single documents in EE.

---

[1] "The Tbilisi Declaration," Connect, (Paris, France) vol. III, no. 1, January 1978, p. 1-8.

A number of the components of the Tbilisi Declaration and recommendations appear in th document in Chapter III. Of critical importance to EE, however, is the Declaration's persistent reference to the need for EE to get citizens actively involved at all levels in working toward the resolution of environmental problems. Coupled with this is the realization that all individuals must acquire the knowledge, skills, attitudes, and commitments necessary to protect and improve the environment. Thus, the Declaration faces squarely the epitomizing challenge and ultimate guideline for EE - that of citizenship responsibility for and participation in environmental problem solving.

At the time of this writing, current EE curricular patterns throughout the world demonstrate a wide variety of goals. Many of the goals reflected by this program are consistent with the objectives presented in the Tbilisi Declaration. However, if one looks at the Declaration's objectives as a continuum beginning with environmental awareness and ending with citizen participation, a great deal of variation exists. Some curriculum efforts deal primarily with ecological principles and others go beyond ecology to attempt to show the relationships existing between ecological concepts and environmental issues. A nominal number of others reach further along the continuum and attempt to deal with participation variables associated with the investigation, evaluation, and remediation of issues.

Few common threads appear which allow one to synthesize a construct one could call "extant environmental education curricula." Diversity seems to be the major pattern one observes. However, in all of these there seems to be a strong desire on the part of curriculum developers to attempt to inculcate an environmental ethic within the receiver populations whether made up of young children or adults beyond the college years. One project, for example, designed for the elementary children of the Nordic countries attempts, in part, to provide instruction in the respect for nature and promote environmental protection.[1] Another, developed for West African adult village inhabitants, attempts, in part, to prevent environmental degradation and teach the usefulness of animal protection.[2] A governmental educational decree in Colombia directs that the teaching of ecology and the protection of environmental and natural resources be introduced in all the country's educational institutions.[3] In Israel, a new curriculum for the ninth grade emphasizes the ethical responsibilities of man with respect to his biological superiority.[4]

As noted by the UNESCO research cited earlier in this chapter, educational programs based on real problems and solutions to real problems are nonexistent in the nations surveyed. Fortunately, however, efforts are being made by some curriculum developers to bring social relevance to EE. One curriculum project for the middle or secondary years is specifically designed to provide receivers with those skills necessary to investigate, evaluate, and take action with respect to environmental problems.[5] Even though few of these kinds of projects exist today, future curricula throughout the world should provide for similar goals as a function of the citizen(s) participation objective established by the Tbilisi Conference.[1]

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[1] "Nordic Cooperation in Environmental Education," Connect, vol. III, No. 4, December 1978, p. 6.

[2] "West Africa," Connect, vol. III, no. 4, December 1978, p. 6.

[3] "Ecology Makes It In Colombia," Connect, vol. III, no. 4, December 1978, p. 6.

[4] Sabar, Naama. "Science, Curriculum, and Society: Trends in Science Curriculum," Science Education (USA), vol. 63, no. 2, April 1979, p. 265.

[5] Hungerford, H.R., Peyton, R.B., Litherland, R.A., and Tomera, A.N. Investigation and Action Skills for Environmental Problem Solving. Champaign, Illinois: Stipes Publishing Company, 1978.

Research findings in a number of instances are quite clear in that receivers who are involved in environmental programs predicated on awareness objectives cannot be predicted to become active participants in environmental problem solving. Conversely, however, a growing body of knowledge indicates that receiver groups who have been trained in citizenship participation strategies will, indeed, be prone to become citizen participants in issue remediation. This research information plus the guidelines established by the Tbilisi Conference should serve to guide curriculum developers to establish programs which reach toward citizenship participation. In this way, stewardship behaviors may finally be attained by the world's citizenry. When one considers the total biosphere of earth, there is no greater goal!

---

[1] Intergovernmental Conference on Environmental Education, Tbilisi 1977. Final Report. UNESCO, Paris, 1977.

CHAPTER III

EE CURRICULUM AND MATERIALS DEVELOPMENT

> . . . ' to defend and improve the environment for present and future generations has become an imperative goal for mankind.' This undertaking urgently calls for new strategies . . . and bring together, as soon as possible, all available resources. Education utilizing the findings of science and technology should play a leading role in creating an awareness and a better understanding of environmental problems. It must foster positive patterns of conduct toward the environment and nations' use of their resources.
>
> Connect, vol. III, no. 1,
> January 1978, p. 1.

Guidelines for Designing EE Curriculum Format

Environmental educators have spent considerable time and effort defining the goals and purposes of EE. The general concensus is that EE should be training world inhabitants who are both capable and willing to choose life-styles and behavior which allow the environment to maintain itself in a productive and supportive ecosystem, i.e., to train receivers to become environmentally literate citizens. There are, of course, many dimensions implied by such a mission. They are more formally defined later in this chapter. The purpose of this section is to give direction to EE so that choices regarding the format of the environmental education curriculum can be made.

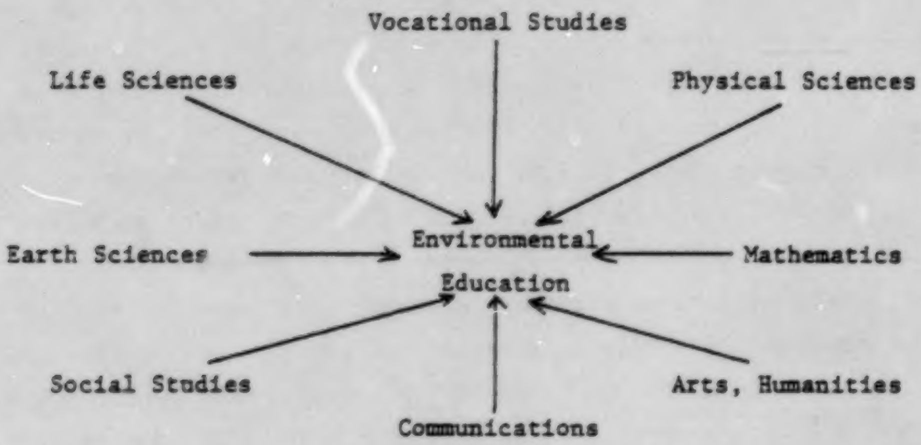
Models for EE Formats

EE has traditionally been considered "interdisciplinary" due to the complexity of its nature and its reliance on practically all other disciplines, e.g., science, math, geography. In fact, there has been some reluctance to refer to EE as a "discipline" lest its holistic nature be lost.[1]

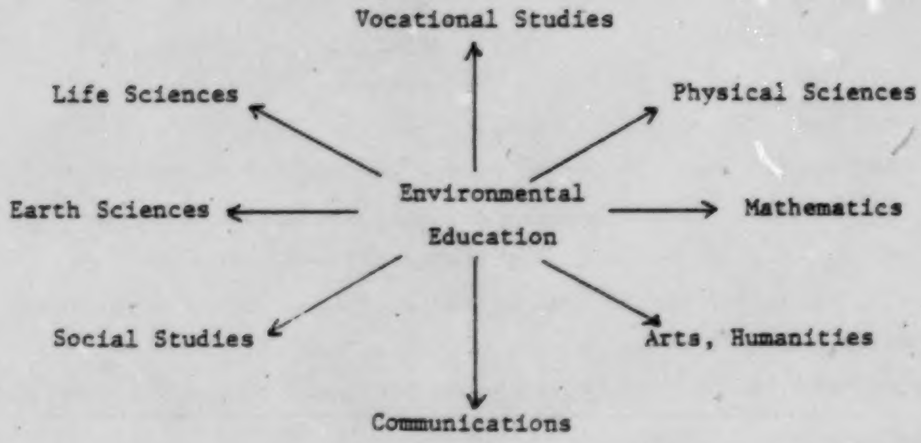
---

[1] The writers feel there may be some danger at times in refusing to give EE "discipline status" since it tends to prevent the identification of a substantive structure of EE necessary for effective curriculum development, implementation, and evaluation. Environmental education is no less an academic discipline than disciplines such as biology or social studies which, in turn, represent "interdisciplines" of subsumed subjects.

Interdisciplinary (Single Subject) Model vs the Multidisciplinary (Infused) Model


Vocational Studies
Life Sciences
Physical Sciences
Earth Sciences
Environmental Education
Mathematics
Social Studies
Arts, Humanities
Communications

(A) Interdisciplinary Model


Vocational Studies
Life Sciences
Physical Sciences
Earth Sciences
Environmental Education
Mathematics
Social Studies
Arts, Humanities
Communications

(B) Multidisciplinary
(Infusion) Model

Figure 1. Two conceptual models of EE curriculum. In (A) relevant components of many disciplines are drawn upon to create a distinct EE unit, course, or module. (B) illustrates the infusion of EE components into other established disciplines where appropriate.

Implementation of EE into the curriculum must reflect this complexity. Generally, two models have most commonly been utilized in EE curriculum development and implementation. These models are diagrammed in Fig. 1.

Terminology referring to the two models in Figure 1 is confusing since standard uses of terms have not yet been established in EE literature. For the purposes of this document, the creation of a discrete course or series of courses (K - 12), unit or other curricular package shall be termed an interdisciplinary approach (Model A). The incorporation of EE components in other established, interrelated disciplines will be referred to as multidisciplinary (*infusion*) approach (Model B).[1]

In order to summarize some of the considerations to be made in deciding which curriculum organization should be selected for use in a particular school, region, or nation, Table I has been prepared. Each organizational approach in this table can be seen to offer both advantages and disadvantages.

4. Guidelines for the Acquisition and Transfer of Knowledge and Skills.

The production of environmentally literate citizens through formal education implies that knowledge, cognitive skills, and attitudes not only be *acquired* in the classroom, but also that these be *transferred* to the decision-making processes of the receivers throughout their lives. Acquisition and transfer of information and cognitive processes are, of course, not unique endeavors of EE - they are shared by most other disciplines. Unfortunately, many of the components of curriculum in education reflect only the goal for receivers to acquire knowledge and cognitive processes. It is equally important for EE curriculum developers to strive for the ultimate goal of *transfer* in selecting curricular formats and methodologies. The following discussion emphasizes some of the guidelines to be considered if curriculum developers are to achieve both acquisition and transfer.

Research into the transfer of learning has provided some useful general-

---

[1] The terms "interdisciplinary" and "multidisciplinary" are often used for "monodisciplinary" and "infusion", respectively. However, it is obvious from the literature that common agreement on the use of these terms is lacking. Further discussion on this topic may be found in Moroni, Antonio. "Interdisciplinarity and Environmental Education." *Prospects: Quarterly Review of Education* (USA) vol. VIII, no. 4, 1978, p. 480-494.

Table I. Interdisciplinary vs Multidisciplinary (Infusion) Formats for EE: Advantages and Disadvantages.

Considerations	Interdisciplinary Characteristics	Multidisciplinary (Infusion) Characteristics
1. Ease of Implementation.	Easier to implement as a single subject if time permits in the curriculum; teacher training is less of a problem.	Requires that more teachers be trained; greater coordination of curriculum necessary; requires less time/content in existing curriculum.
2. Teacher Competencies.	May require fewer teachers but with more in-depth training in EE; thus teacher training is less demanding in terms of teacher numbers but more demanding in terms of level of competencies required.	Requires that teachers of all disciplines be competent to adapt and/or use EE materials, although perhaps not to the same depth as in interdisciplinary approaches.
3. Demand on Curriculum Load.	Requires addition of this discipline to an already crowded curriculum.	May be effectively implemented with minimal demands on existing curricular load.
4. Ease of Curriculum Development.	Components easier to identify and sequence.	Components must be effectively identified, sequenced, and accommodated by the existing curriculum.
5. Evaluation.	A comprehensive evaluation is much easier to accomplish in a single subject curriculum.	Comprehensive evaluation difficult due to the number of variables involved.
6. Age Level Appropriateness.	May be more appropriate at secondary than elementary levels. For some types of EE goals, may be essential at secondary and tertiary levels.	Appropriate at all age levels with some exceptions at secondary and tertiary levels.
7. Effectiveness in Teaching for Transfer.	More difficult to use in effectively teaching for transfer. Requires special efforts to do so.	Teaching for transfer is inherent in this approach when properly used. Infusion permits decision-making to take place in other disciplines in an environmental context.

Continued . . .

Table I, Continued.

Considerations	Interdisciplinary Characteristics	Multidisciplinary Characteristics
8. Ability to Provide In-Depth Coverage of Environmental Issues.	Usually more effective due to time available and teacher expertise.	More comprehensive, but requires extensive curriculum coordination to achieve in-depth coverage throughout the program.
9. Budget.	Budget consideration entirely dependent on the nature of the course being developed. A highly sophisticated course demanding many field excursions or laboratory equipment could prove costly.	Monetary considerations very dependent on the nature of the curriculum being developed. Monies required could be greater than in a single subject curriculum due to numbers of receivers involved across numerous grade (age) levels.

izations for curriculum developers.[1] It seems that transfer of knowledge and skills is more likely to take place . . .

(1) . . . when students have experience with a diversity of problems. Exposure to a wide range of problems helps to develop an expectancy that each problem will have to be solved in a somewhat different way . . .

(2) . . . when students learn to apply principles in situations with distracting and irrelevant elements. This is necessary if the student is to learn to discriminate between relevant and irrelevant features of situations so that the principles involved may be identified and accurately applied . . .

(3) . . . when opportunities are provided for the pupil to learn and use knowledge in a variety of situations. This is based on research findings that acquired knowledge tends to be most used in the situation in which it was acquired.

In effect, research says that if we want transfer to occur, we must teach for transfer. These principles of transfer may be - and should be - applied in both interdisciplinary and multidisciplinary (infusion) type EE curriculum formats. However, these principles offer a great defense for the argument that EE should be infused throughout educational systems. The multidisciplinary or infusion will allow students to apply EE concepts and problem solving skills in a great variety of situations over a long period of time. Many of the concepts and mental processes which are desired as outcomes of EE have traditionally been taught separately in other disciplines. For example, students often learn how their government works in civic or social studies classes. However, in spite of the acquisition of such knowledge, students fail to use knowledge effectively as citizens in environmental (or other) problem solving. A major factor contributing to this lack of use may be inferred from the principles listed above. Students were taught about government decision-making, but not how to use the knowledge in their daily lives.

Perhaps one more example will help to make the case for using the multidisciplinary model. Teachers should not expect students who learn about ecology in science classes to apply those understandings consistently or effectively when considering concepts of economics, social studies, or other disciplines unless they are taught to do so. If students consider ecological consequences of issues in a variety of situations throughout their formal education, there is greater reason to expect them to use this knowledge in their own non-academic lives as well.

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[1] A more complete discussion of these and other principles of transfer may be found in Travers, Robert M. W. Essentials of Learning. New York, The MacMillan Company, 1972.

The above discussion is not intended to exclude an interdisciplinary approach as an effective format for EE. An effective, total EE program must include curricular components of both designs, with increasing use of interdisciplinary materials at higher levels and/or where greater depth of comprehension is desired. Sound educational procedures must be used in either format if EE goals are to be achieved (e.g., the transfer of critical thinking/problem solving skills). Curriculum developers must keep all of these considerations in mind when selecting formats for EE materials at various grade levels.

The guiding principles for EE, as outlined in the Tbilisi Declaration, reflect a definite need for both the acquisition and transfer of learning in environmental education. Program developers should strive to reflect these guiding principles in any curriculum development project, making certain that the need for both acquisition and transfer is met. These guiding principles follow:

Environmental education should:

- consider the environment in its totality - natural and built, technological and social (economic, political, cultural-historical, moral, esthetic);
- be a continuous lifelong process, beginning at the pre-school level and continuing through all formal and nonformal stages;
- be interdisciplinary [1] in its apprach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;
- examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas;
- focus on current and potential environmental situations and international cooperation in the prevention and solution of environmental problems;
- explicitly consider environmental aspects in plans for development and growth;

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[1] This is an instance where the use of either the terms "interdisciplinary" or "multidisciplinary" is confusing. The writers feel that the use of "interdisciplinary" in this guideline does not exclude multidisciplinary (infusion) model discussed earlier.

- enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;
- relate environmental sensitivity, knowledge, problem-solving skills and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years;
- help learners discover the symptoms and real causes of environmental problems;
- emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills;
- utilize diverse learning environments and a broad array of educational approaches to teaching/learning about and from the environment with due stress on practical activities and first-hand experience.

Connect, vol. III, no. 1,
January 1978, p. 3.

Criteria for Decision-Making in Environmental Curriculum Development

The environmental curriculum is the sum total of all of the experiences learners have under the auspices of the school that relate to the knowledge, skills, attitudes, and human behaviors associated with the acquisition of an environmentally-appropriate life style.

The definition of the environmental curriculum stated above implies far more than the preparation of documents intended for use in the classrooms of a school or a nation. It implies - additionally - the responsibility of curriculum developers to prepare curricula that will stimulate learning of conceptual knowledge, provide for the attainment of problem solving skills, allow for the alteration of value constructs, and provide for training in and opportunities to apply appropriate citizenship behaviors. Therefore, the entire process of curriculum development involves far more than the preparation of materials. Involved in this process would be decision-making concerning goals and objectives, subject matter to be used to meet the desired goals and objectives, the organization of that subject matter, methods to be used in teaching the subject matter, and the evaluation of the extent to which the content and methods meet the desired goals and objectives.

Other ancillary yet critical elements which must be considered in any curriculum development project include determining the validity of the source of the goals, analyzing the need for inservice teacher training for the new curriculum, shaping the curriculum so that it fits within the physical and financial resources of the school, and the criteria that govern the selection of the content (subject matter) to be used in the curriculum.

Although a plethora of models and proposals exist which deal either with EE curriculum development or a substantive structure for EE, the writers choose - somewhat arbitrarily - to focus on the goals established by the Intergovernmental Conference on EE, organized by Unesco in cooperation with UNEP, Tbilisi, Georgia (USSR) in October 1977. Because this conference was attended by representatives of 68 Member and non-Member States and because the now-famous Tbilisi Declaration was drafted there, it appears both pragmatic and valid to utilize that Declaration as the guiding focus for curriculum development in EE.

The Tbilisi Declaration provides a substantial footing for decision-making in EE. It communicates criteria for developing environmental education programs, goals for EE, categories of EE objectives, and guiding principles. Any school system - large or small - should focus on these components when making curriculum decisions in environmental education. Of particular concern to this section of this document are the goals and objectives of environmental education established by the Tbilisi Conference. They follow :

> The goals of environmental education are:
>
> - to foster clear awareness of, and concern about, economic social, political and ecological interdependence in urban and rural areas;
>
> - to provide every person with opportunities to aquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;
>
> -to create new patterns of behavior of individuals, groups and society as a whole towards the environment.
>
> The categories of environmental education objectives are:
>
> AWARENESS: to help social groups and individuals aquire an awareness and sensitivity to the total environment and its allied problems.
>
> KNOWLEDGE: to help social groups and individuals gain a

> variety of experience in, and acquire a basic understanding of, the environment and its associated problems.
>
> ATTITUDES: to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
>
> SKILLS: to help social groups and individuals acquire the skills for identifying and solving environmental problems.
>
> PARTICIPATION: to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

Connect, vol. III, no. 1,
January 1978, p. 3.

Can these goals and objectives be translated into an effective EE curriculum? The writers believe that they can be highly appropriate, particularly if an intermediate set of goals for curriculum development is adopted. Said intermediate set of goals would communicate specific goal statements which could then be translated into instructional objectives around which EE materials could be developed. If developed logically and validated, goal statements can make the task of curriculum development easier by providing developmental guidelines for a logical scope and sequence. Because appropriate developmental syntax is crucial to effective curriculum development, logically arranged goal statements will help control for a major source of program development error, i.e., a program developed without regard for a logical and developmental scope and sequence.

Such a set of goals - validated by a panel of distinguished environmental educators and with the Tbilisi Declaration objectives - has been developed for use in North America by the writers in cooperation with Dr. Richard J. Wilke of the University of Wisconsin. These goals will be used in this document as a model consistent with the Tbilisi Declaration. Although curriculum developers in other nations may find it necessary or desirable to modify these goals to meet local and/or national needs, the developmental and syntactical structure of the goals presented here should serve as a structural example and facilitate the development of a locally useful set of curriculum goals. Thus, the goals presented here can serve a useful role in EE curriculum decision making.

The curriculum development goals that follow are organized into four levels. Although hierarchical with respect to the development of knowledge, skills, and attitudes, they are not necessarily restricted to particular grade levels. For example, certain goals for Level III could be used for curriculum development in the primary grades (ages 5 - 8) while certain content for Level I might well deserve attention with adult receiver populations. This could be extremely important in curriculum development situations calling for a spiral development of knowledge, skills, and attitudes, i.e., a situation where these components are taught with increasing thoroughness as receiver populations increase in maturity.

Level I goals focus on ecological concepts. Level I is a knowledge level, providing receivers with that knowledge which can help them make ecologically sound environmental decisions. Level II is also at a knowledge level, focusing on information (awareness) concerning many aspects of human environmental behavior. Level III is at a cognitive process or skills level, focusing on those skills needed for issue investigation, evaluation, and values clarification. Level IV is also a process or skills level, focusing on those processes important to citizenship action (participation). The goals follow:

GOALS FOR CURRICULUM DEVELOPMENT IN ENVIRONMENTAL EDUCATION [1]

Level I. Ecological Foundations Level.

This level seeks to provide the receiver with sufficient ecological knowledge to permit him/her to eventually make ecologically sound decisions with respect to environmental issues.

The ecological foundations level would include a minimum of the following conceptual components:

A. Individuals and populations.
B. Interactions and interdependence.
C. Environmental influences and limiting factors.
D. Energy flow and materials cycling (biogeochemical cycling).
E. The community and ecosystem concepts.
F. Succession.
G. Homeostasis.
H. Man as a member of ecosystems.
I. The ecological implications of man's activities and his communities.

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[1] Adapted from the original research document by H. R. Hungerford, R. B. Peyton, and R. J. Wilke by the writers specifically for use in this publication.

Level II. Conceptual Awareness Level - Issues and Values.

This level seeks to develop a conceptual awareness of how individual and collective actions can influence the relationship between quality of life and the quality of the environment . . . also, how these actions result in environmental issues which must be resolved through investigation, evaluation, values clarification, decision making, and finally, citizenship action.

Goals at this level are presented to provide opportunities for receivers to conceptualize . . .

A. . . . how man's cultural activities (e.g., religious, economic, political, social, etc.) influence the environment from an ecological perspective.

B. . . . how individual behaviors impact on the environment from an ecological perspective.

C. . . . a wide variety of environmental issues and the individual, cultural, and/or ecological implications of these issues.

D. . . . the alternative solutions available for solving environmental issues and the ecological and cultural implications of these alternatives.

E. . . . the need for environmental issue investigation and evaluation as a prerequisite to sound decision making.

F. . . . the roles played by differing human values in environmental issues and the need for personal values clarification as an integral part of environmental decision making.

G. . . . the need for responsible citizenship action (e.g., persuasion, consumerism, legal action, political action, ecomanagement) in the solution of environmental issues.

Level III. Investigation and Evaluation Level.

This level provides for the development of the knowledge and skills necessary to permit receivers to investigate issues and evaluate alternative solutions for solving these issues. Similarly, values are clarified with respect to these issues and alternative solutions. Goals at this level are presented in two components.

Level III. Component A. Goals for Component A are to develop in receivers . . .

A. . . . the knowledge and skills needed to identify and investigate issues (using both primary and secondary sources of information) and to synthesize the data gathered.

B. . . . the ability to analyze environmental issues and the associated value perspectives with respect to their ecological and cultural implications.

C. . . . the ability to identify alternative solutions for discrete issues and the value perspectives associated with these solutions.

D. . . . the ability to autonomously evaluate alternative solutions and associated value perspectives for discrete environmental issues with respect to their cultural and ecological implications.

E. . . . the ability to identify and clarify their own value positions related to discrete issues and their associated solutions.

F. . . . the ability to evaluate, clarify, and change their own value positions in light of new information.

Level III. Component B. Goals for Component B are to provide receivers with opportunities to . . .

G. . . . participate in environmental issue investigation and evaluation.

H. . . . participate in the valuing process in a manner as to permit the receiver to evaluate the extent to which his/her values are consistent with the major goal of achieving and/or maintaining a dynamic balance between quality of life and quality of the environment.

Level IV. Environmental Action Skills Level - Training and Application.

This level seeks to guide the development of those skills necessary for receivers to take positive environmental action for the purpose of achieving and/or maintaining a dynamic balance between quality of life and the quality of the environment. Goals at this level are presented in two components.

Level IV. Component A. The goal for Component A is to develop in receivers . . .

A. . . . those skills which will permit them to effectively work toward ends which are consistent with their values and take either individual or group action when appropriate, i.e., persuasion, consumerism, political action, legal action, or ecomanagement.

Level IV. Component B. The goals for Component B are to provide receivers with opportunities to . . . [1]

B. . . . make decisions concerning environmental action strategies to be used with respect to particular issues.

C. . . . apply environmental action strategies to specific issues, i.e., to take citizen action on one or more issues.

D. . . . evaluate the actions taken with respect to their influence on achieving and/or maintaining a dynamic balance between quality of life and the quality of the environment.

Earlier it was noted that the developers of the above goals conducted a comparison of the goals with the Tbilisi Conference Categories of Objectives. This comparison can be observed in Figure 2. Each time the developers' goals favorably matched one or more of the Tbilisi Objectives, the situation was noted with "X". This validity comparison is presented here to provide an opportunity for the reader to judge that comparison personally and/or as a model should the reader(s) choose to develop another set of goals which could be compared against the Tbilisi Objectives.

(Figure 2 goes about here.)

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1. Component B goals are stated in such a way as to imply only that opportunities be provided for these behaviors. In the realm of environmental action, it may be ethically inappropriate to assign a receiver the responsibility of taking direct action. However, the writers believe that opportunities should be provided which permit the receiver(s) to use action skills which have been acquired.

Developers' Validity Assessment: A Comparison of the Goals for Curriculum Development In Environmental Education to the Tbilisi Conference Categories of Objectives (1977).

Tbilisi Objectives					Developers' EE Curriculum Goals by Level
Awareness	Knowledge	Attitudes	Skills	Participation	
1	2	3	4	5	Level I. Ecological Foundations Level
X	X				All Subcomponents (A-I)
1	2	3	4	5	Level II. Conceptual Awareness Level Subcomponent:
X	X				A.
X	X				B.
X	X				C.
X	X				D.
X	X	X			E.
X	X	X			F.
X	X	X			G.
1	2	3	4	5	Level III. Investigation and Evaluation Level Subcomponent:
X	X		X		A.
X	X		X		B.
X	X		X		C.
X	X		X		D.
X		X	X		E.
X	X	X	X		F.
X	X	X	X	X	G.
X		X			H.
1	2	3	4	5	Level IV. Action Skills Level Subcomponent:
			X		A.
			X	X	B.
				X	C.
				X	D.

Figure 2.

Benefits Derived From Using the Goals for Curriculum Development in the Production of Instructional Programmes for EE.

The Goals for Curriculum Development in Environmental Education have a potential usefulness that transcends current practice in EE and even transcends EE itself. As noted elsewhere in this document, research conducted on a world-wide basis indicates that EE programmes are largely of an awareness nature with little emphasis being placed on problem investigation or solution. The goals presented here allow for - even require - the development of problem investigation and solution skills. Further, the content used in the development of autonomous investigators need not be the classic content of environmental education. The content can transcend EE per se by dealing with substantive socio-cultural issues which plague man in numerous parts of the world. These problems could include, for example, issues related to personal, village, or public health on a regional basis. They could include issues related to tillage, crop production, and food preservation. Of course, issues such as these are closely tied to the environment and the welfare of man but need not be environmentalized as such in order to be dealt with in accordance with the investigation, evaluation, and citizenship responsibility goals expressed in this document.

Neither do the goals need to be used only by curriculum developers in developed nations. They are equally suitable for use in developing nations. Young people and adults in all nations can be helped to understand their role in the total environment by becoming astute observers, investigators, and decision-makers. In addition, the investigation of issues from both an ecological as well as socio-cultural perspective enables the receiver (regardless of age or socio-economic status) to view the issue holisticly and perceive the interrelationships that exist between the natural environment and man's cultural activities. The goals as expressed in this document, if appropriately applied, will aid in this process.

More importantly perhaps is the opportunity to train effective decision-makers who will, in their own villages, communities, or cities, act in consort with ecological principles which will promote a quality of the environment as well as a quality of life for the individual. The goals as expressed in this document promote the development of citizenship responsibility skills and provide for an opportunity for receivers at all age levels to demonstrate these skills through responsible environmental behavior.

The Goals for Curriculum Development in EE do, indeed, allow for the development of a comprehensive and holistic environmental education curriculum - one which considers not only ecological principles but the implications of man's activities in an infinite number of ways. The goals permit the curriculum developer to use those issues/problems which are critical to the immediate area in which the curriculum is to be used. Thus, the goals act as a generic vehicle for the development of comprehensive EE programmes in both developed and developing nations.

Continued . . .

Applying the Goals - An Instructional Model

Regardless of the set of goals used by the curriculum developer, a functional instructional model must be applied in order to achieve any semblance of validity in the final product. To produce curricula without serious consideration being given to the act of instruction usually results in invalid, inappropriate, and inconsistent materials.

An instructional model which could be used in any school district, region, or nation for EE curriculum development is diagrammed in Figure 4. This diagram provides a model for the curriculum developer which, if applied rigorously, can result in organized, internally consistent, and valid EE materials for any receiver group. Further, it can be applied to any grade level and any content area. Of major significance is the fact that this model can be applied by any curriculum development team using any set of appropriate curriculum goals, i.e., the goals being applied do not necessarily have to be those presented in the previous section of this document.

Parts A, B_1, B, and C of Figure 3 constitute the heart of curriculum and instruction. Pretesting (B_1) should be incorporated only when needed, i.e, there are times when a particular receiver group, receiving a certain instructional package, will not need pretesting based on information already known to the instructor.

Goals (A_1) and curriculum evaluation (D) have also been included in Figure 3 to show how they are related to curriculum and instruction as such. Goals have already been discussed in this document and evaluation is considered in another section. Therefore, these components will not be discussed here except to note that they, too, are interrelated with all other components.

Each of the major components of the model seen in Figure 3 will be discussed briefly below:

Instructional objectives (A) are critical to the entire process of curriculum development and instruction. This component establishes what the learner is to learn, i.e., what the instructor is to teach.

The selection of instructional objectives should be based on: (1) the curriculum goals being used, (2) the scope and sequence of the curriculum under development, (3) what behaviors the students are expected to demonstrate

Curriculum Development and the Instructional Process

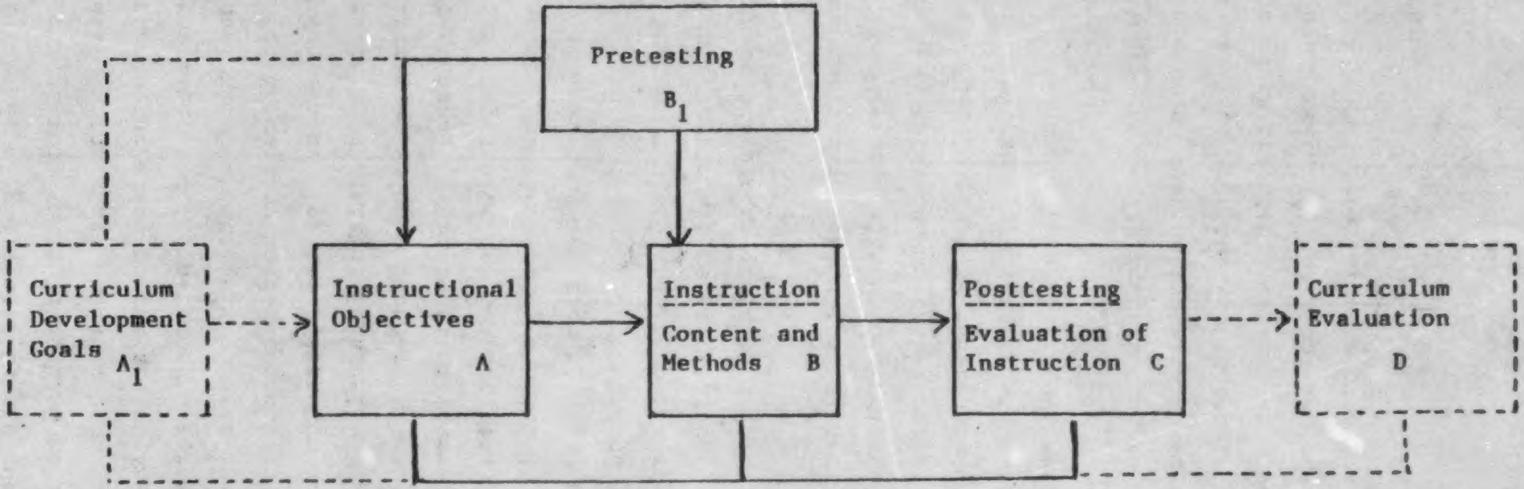
Pretesting
B_1
Curriculum Development Goals A_1
Instructional Objectives A
Instruction
Content and Methods B
Posttesting
Evaluation of Instruction C
Curriculum Evaluation
D

Figure 3. Schematic diagram reflecting components of the instructional process plus original curriculum development goals and subsequent curriculum evaluation. A, B, and C constitute the critical components of instruction, i.e., instructional objectives, content and methods, and posttesting. Pretesting (B_1) must also be considered as an integral component when needed in the instructional process. Note the interrelatedness of all components. These relationships must be constantly respected in any curriculum development and instructional effort in order to maintain any semblance of validity.

subsequent to instruction, (4) what the students' capacities are at the beginning of instruction, and (5) the resources available to the instructor (school).

Once the instructional objective is selected it should be inspected for consistency with the goals being used. It should also probably be stated in performance terms in order to permit the instructor to measure its acquisition during or subsequent to instruction. Several examples of performance objectives appropriate for the goals used in this document are stated in the following list:

Goals	Objective
Level I Part G	(1) Subsequent to the unit on homeostasis, the students will be able to write an appropriate definition for the term.
Level I Part G	(2) Subsequent to the unit on homeostasis, the students will visit a local, stable ecosystem and cite at least three (3) variables that contribute to the homeostatic nature of that ecosystem.
Level II Part A	(3) Following a unit on man's cultural activities and the environmental implications of these activities, students will be able to state two (2) ways in which regional ecosystems are threatened by man's activities. Similarly, students will be able to explain why these activities threaten said ecosystem.
Level III Part A	(4) After completing the module on investigation using secondary sources, the students will draw an issue (from a set of issues prepared by the instructor) from a container and locate at least six (6) current references dealing with that issue from the card catalog and/or the Readers' Guide (or any other appropriate sources assigned by the instructor).
Level IV Part A	(5) Students completing the module on environmental action will be able to write a suitable definition for consumerism and cite at least two current issues that could possibly be influenced by that mode of action.

(Note: The five objectives written above are examples only and do not necessarily constitute the writers' recommendations for objectives for particular goal levels.)

The benefits of using performance objectives (P.O.'s) are many. A few of these benefits follow: (1) P.O.'s contribute to the logical sequencing of content in curriculum development. (2) P. O.'s contribute to effective communication concerning expected outcomes between developers, students, teachers, and parents. (3) P.O.'s help provide a mechanism whereby both instruction and curricula can be evaluated. (4) P.O.'s promote efficient learning when students realize what is expected of them. (5) P.O.'s facilitate pretesting when this component is appropriate. (6) P.O.'s help researchers measure the acquisition of particular goals.

Pretesting (B_1) is undoubtedly of great value when an instructor is beginning a new unit or commencing to work with a group of unfamiliar students. When used, pretesting should involve an evaluation of the extent to which students have already mastered the performance objectives reflected in the curriculum. Pretesting must be consistent with the objectives and anticipated instruction if to be of any value whatsoever.

In situations where the instructor is thoroughly familiar with the receivers - or where courses are very sequential in nature - pretesting for every unit or module may not be necessary.

Instruction: Content and Methods (B) involves the selection of the content most appropriate for getting students to master the objectives in question. Also involved are the selection of suitable methods, the selection of instructional materials to be used, and the sequencing of activities used in instruction.

Content used for achieving particular goals may differ from school to school or nation to nation. Certainly, students living in a tropical rain forest should learn the concepts associated with "ecosystem" by interacting with the rain forest. It would be foolish to ignore the student's own regional biome and focus on another in a distant region, e.g., tundra. Similarly, environmental issues vary from region to region and those of immediate concern to the student should be used - at least initially - when curricula are being prepared.

The availability of instructional materials will also differ from school to school and region to region. Some schools may have access to many visual aids while another does not. The same is true for library resources, access to the representative biome, and laboratory facilities. These considerations must be kept sharply in focus when developing curricula.

Modes of instruction are critically important to the curriculum developer and instructor. The best available methods should be employed when designing instructional sequences. A field trip may prove eminently more profitable.

than a lecture about a resource. Debate may provide considerably more values clarification potential than simply reading about an issue. A laboratory may well teach far more about an ecological principle than a discussion about that principle. Methods can make the difference between a powerful learning experience and one that fails to result in the acquisition of desired knowledge, skills, or attitudes.

Posttesting (C) may, in fact, be a poor term to describe all of the attributes of this component because it infers that instructional evaluation will take place upon the completion of a unit or module. Certainly, many objectives can and will be evaluated enroute, as students progress through the learning sequence. Many affective objectives, for example, can be evaluated by the instructor's observation of receiver behavior during a variety of activities, e.g., the student's involvement in the values clarification process during a debate, a case study analysis, or a simulation activity.

Still, many objectives will be evaluated subsequent to instruction. Regardless of when evaluation takes place, the critical thing to keep in mind is to guarantee that students are evaluated on the objectives as stated, in a manner consistent with instruction. Herein lies a much too common problem in education, that of preparing objectives, providing instruction, and then evaluating receivers on some other set of objectives.

If the performance objectives have been carefully prepared and clearly stated, evaluation becomes a relatively simple matter. Of course, the evaluation mode or strategy will depend entirely on the way in which the objectives have been stated, i.e., the evaluation instrument will measure what the objectives specify as appropriate human behavior following instruction.

Oftentimes educators infer that the evaluation process is measuring only student success. This is only partly true in that posttesting is a remarkably good indicator of the suitability or success of instruction, particularly if the objectives and instruction are sound. Posttesting is also a powerful mechanism for establishing the need for revision in either the objectives or instruction or both. When revision is called for it should be undertaken promptly and with careful planning.

Thus far the reader has been introduced to a set of goals for curriculum development which have been validated against the Tbilisi Declaration and a model for curriculum development and the instructional process. It appears appropriate to include with this document a series of sample activities which have been thoroughly developed in accordance with the infusion process, the goals for curriculum development, and the curriculum development model.

The reader will find a set of sample activities in Appendix A. These activities are individual, discrete ones and, in themselves, do not represent complete units or curricular packages. They do, however, represent lessons that could be incorporated into curricula based on the goal statements found in this document.

Continued . . .

Procedural Guidelines and Considerations for Curriculum Development

It is the purpose of this section to identify and discuss some specific steps in the development of curriculum in EE. Obviously, the process will have to be modified to fit the specific needs of each school's, region's, or nation's unique educational situation. The key steps being presented in this section follow:

I. Organize a curriculum Core Development Team (CDT).
   A. Choose CDT members.
   B. Establish tasks and timelines for the CDT.
   C. Collect appropriate resources, e.g., curriculum materials and professional references.
   D. Identify the constraints that will impinge upon the curriculum development effort and plan for resolving same.

II. Identify professional consultants who will serve as a Recommended Support Team (RST).
   A. Establish tasks and timelines.
   B. Identify liaison procedures to be used between RST and CDT.

III. Develop the curriculum's scope and sequence.
   A. Define curriculum goals.
   B. Define concepts, skills and attitudes to be incorporated as objectives into the curriculum (the scope).
   C. Assign objective components to appropriate grade levels and content areas (the sequence).

IV. Evaluate the existing school program with respect to potential EE infusion elements.
   A. Identify EE objectives which already exist in the present curriculum.
   B. Identify materials in present curriculum which could be modified to meet EE objectives.
   C. Identify deficiencies in present curriculum where new materials must be selected or developed to complete the proposed EE scope and sequence.

V. Inventory and evaluate the community/regional resources available for use in the EE curriculum.

VI. Prepare the EE curriculum.
    A. Review and evaluate the materials which have been collected for potential adaptation or adoption.
    B. Organize writing teams to adapt or develop EE materials needed to complete the curriculum.
VII. Develop plans for both pilot and full scale implementation.
VIII. Develop a comprehensive evaluation program.

The Overall Curriculum Development Committee (Team)

The actual size of this team or committee may ultimately be determined by the scope of the curriculum being developed. However, areas of expertise can be recommended in two key sub-groups of such teams: the Core Development Team (CDT) and the Recommended Support Team (RST). Members of the CDT include content area representatives and/or generalists, a teacher coordinator, and representative(s) of the administration. The RST could include curriculum development specialists, EE specialists, environmental scientists, appropriate community representatives and program evaluation specialists. One member of the CDT should be selected as the team leader.

The CDT has a major responsibility for curriculum development. The members of the RST are to be available for specific key tasks (some of which are described below) during the curriculum development phase. Ideally, the services of all recommended committee members would be available at all times. However, time and financial support may inhibit using this approach.

Content area representatives and generalists should be selected from disciplines that will be affected by the final EE curriculum. It is expected that most of this group would be teachers, preferably (although not necessarily) with training or experience in EE. Elementary teachers without specialist training would serve as generalists on the committee.

The teacher coordinator is a vital part of this committee. This person will participate not only in the development of the curriculum, but in its implementation, evaluation and revision as well. The EE coordinator should be an accomplished classroom teacher with training, experience, and interest in EE. During the implementation phase, this person must also be able to work with other classroom teachers in many roles to facilitate the effective implementation of the curriculum. Above all, this person's EE philosophy should be consistent with current thrusts in EE, particularly those evolving from the Tbilisi Conference.

Table 2. Matrix Showing Participation Roles of Committee Members in the Curriculum Development Process.

Roles Membership	Plan Committee Approach	Define Goals and Objectives (Scope)	Assign Objectives to Grade Levels (Sequence)	Assess Existing Curriculum	Assess Community/ Regional Resources	Review Existing Curriculum Materials	Select Materials for Adaptation/Adoption	Develop New Materials	Develop Implementation Plan	Develop Evaluation Plan
Teacher Coordinator	X	X	X	X	X	X	X	X	X	X
Administrator	X	X	X	X	X		X		X	X
Content Specialists	X	X	X	X	X	X	X	X		X
Curriculum Specialist	X	X	X						X	X
EE Specialist		X		X	X	X	X	X	X	X
Environmental Scientist					X		X	X		
Program Evaluator(s)									X	X
Community Representatives	X	X			X				X	

It is also essential that the administration be represented on the CDT so that the efforts of the team be supported by the administration. The administrator chosen must be sympathetic to the team's mission. Implementation of the final curriculum will also be enhanced if administrators understand its importance and particular needs.

Curriculum development specialists (RST) should be available to consult with the team during the initial phases. This expertise will aid in establishing the scope and sequence of the EE curriculum and in planning specific procedures for selecting and developing materials. These consultants may be needed at key points throughout the curriculum development process.

The EE specialists will be used in the development of a valid scope and sequence, in the identification of available EE materials, and refinement of materials developed by writing teams. Environmental scientists may contribute significantly to the development of the content in the curriculum. For example, case studies may be developed around the experiences of scientists working in the field of environmental problem solving.

Community representation is often helpful not only in reflecting the interests and resources of the community, but in getting community support for the curriculum development and implementation. These representatives could well be chosen from parent groups as well as from other community leadership groups. It is sometimes very productive to choose representatives who have serious interests in the environment.

The program must be evaluated and revised to make it most effective. Developing an evaluation scheme will require the use of someone especially trained in program evaluation. A program evaluator (or evaluation team) should be available in the final stages of the curriculum development, and during the implementation and evaluation stages as well.

The table found in this section attempts to identify the minimum roles to be played by each committee member.

Committee Decision Making

Since many of the committee's efforts will be directed toward decision making on difficult and important issues, it seems appropriate to consider some problem solving strategies for small groups. Problem solving efforts can be made more efficient and effective when structured approaches are utilized. References are available which provide detailed instructions for using these techniques.[1] It is recommended that the team leader consult such references or someone experienced in the use of such processes before implementing them. While the basic concepts of the processes are simple, the problem solving sessions will be more effective if certain techniques are utilized.

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[1] An excellent discussion of the use of a small group process known as "Nominal Group Treatment" is provided by Delbecq, Andre L., Van de Ven, Andrew H. and Gustafson, David H. Group Techniques for Program Planning. Glenview, Illinois: Scott, Foresman and Company, 1975.

The following outline of steps are provided only to convey the nature of such a small group process. They are not intended as a basis for implementing the process.

1. The leader presents a nominal question to the group.
2. Individuals silently generate ideas in response to the question in writing.
3. Group members take turns submitting one idea at a time which are recorded on a large flip pad and hung on a wall so they are visible to all.
4. Items are discussed for clarification and categorization.
5. A preliminary vote on item importance is taken.
6. The results of the preliminary vote are discussed.
7. A final vote is taken.

Several phases of the curriculum development process would be appropriate for the use of these creative problem solving sessions. Some of the more important applications are listed below.

1. Identifying the responsibilities of the curriculum development team.
2. Establishing priorities and/or sequencing tasks.
3. Identifying major constraints to the effective development and implementation of the EE curriculum.
4. Identifying means of circumventing major constraints to the committee's goals.
5. Identifying and selecting specific content components of the curriculum. These could include, as examples, major concepts to be included in Level I ecological foundations goals or desired outcomes of Level II goals.
6. Establishing guidelines for the selection of appropriate teaching materials and/or strategies.
7. Coordinating the infusion of the EE curriculum scope into appropriate segments of other disciplinary curricula.

Collecting References

Another major organizational task at this phase is the collection of references and resources. Many of these will be used throughout the project and some attempt should be made to establish a reference library at the onset. Additions may be made to the collection as committee members become better acquainted with the literature in EE. The initial selection of references should represent the minimum topic list which follows. (The bibliography of this document will provide suggestions for many of these).

1. Curriculum development/implementation/evaluation references.
2. Learning theory (implications of learning theory for curriculum development).
3. Environmental education theory/philosophy references.
4. Ecology/environmental science references.
5. Environmental issues references (case studies of local, regional, national, and international issues).
6. EE curriculum samples.

Involving the curriculum development team in locating these references will familiarize members with available materials and sources of materials. Further, this provides an opportunity for members to exchange information and begin developing a common "knowledge pool".

Planning the Curriculum Scope and Sequence [1]

The scope and sequence phase of the project is critical since it will provide direction for futher development of curriculum materials. The first step in establishing this direction is to identify goals for the curriculum. The goals of an EE curriculum are broad, general statements which reflect the underlying value priorities and philosophy of the program. The following goal for EE was adopted at the World Intergovernmental Conference on Environmental Education held in Tbilisi, USSR, 1977.

> To develop a citizenry that is aware of, and concerned about, the total environment, and its associated problems, and which has the knowledge, attitudes, motivations, commitment, and skills to work individually and collectively toward solutions of current problems and the prevention of new ones.

The refining and operationalizing of the general goals of EE into an integrated system of sub-goals, objectives, curriculum materials, teaching strategies and classroom activities is a continuous process in curriculum development and implementation. Earlier sections of this chapter present

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1. Before actual planning of this phase begins, it may be necessary to provide inservice training to the curriculum development team if a number of them lack experience in EE. A discussion of inservice training is provided elsewhere in this document.

examples of the refinement of the overall goal presented above into separate goal levels, sub-goals, sample objectives, and teaching activities. If the goal levels and sub-goals suggested in this document are chosen for use by the committee, the group is still faced with the major task of developing a curriculum scope and sequence before teaching materials can be selected and/or written. The scope (or breadth) defines the extent of coverage by the curriculum in terms of objectives (cognitive, affective, and psychomotor) or statements of ideas or conceptual schemes. The sequence assigns these elements to grade levels based on a hierarchy of concepts, skills, and attitudes.

Figure 4 presents a conceptual model of a curriculum based on the goal levels found in the Goals for Curriculum Development in EE (presented in this document). This model presents a conceptual scheme to illustrate how the scope (operationalized from the goal levels) may be integrated through grade levels (vertical organization) and across appropriate disciplines (horizontal organization). In order to translate this conceptual scheme to a completed EE curriculum, it may be best to proceed through the following three steps:

1. Develop the curriculum's scope by expanding the separate goals within each goal level into specific knowledge, skill, and attitude objectives.
2. Assign these objectives to appropriate grade levels.
3. Assign the objectives within discrete grade levels to appropriate disciplines/content areas.

When preparing the scope of the curriculum, each goal (or sub-goal) must be operationalized by analyzing that goal to determine those behaviors that will lead to the accomplishment of that goal. For example, the concept of "ecological community" may have to be operationalized as several subordinate concepts which can be permutated into performance objecteves. These performance objectives should provide a comprehensive framework within which the acquisition of the community concept can be assessed subsequent to instruction.

Just as conceptual (knowledge) components are specifically developed and stated, so must the scope of cognitive skills and attitudes be identified and developed. For example, a Level III goal in the Goals for Curriculum Development in EE is to ". . . develop in receivers the knowledge and skills needed to identify and investigate issues . . ." The curriculum development team must delineate the nature of these knowledge and skill components so they can

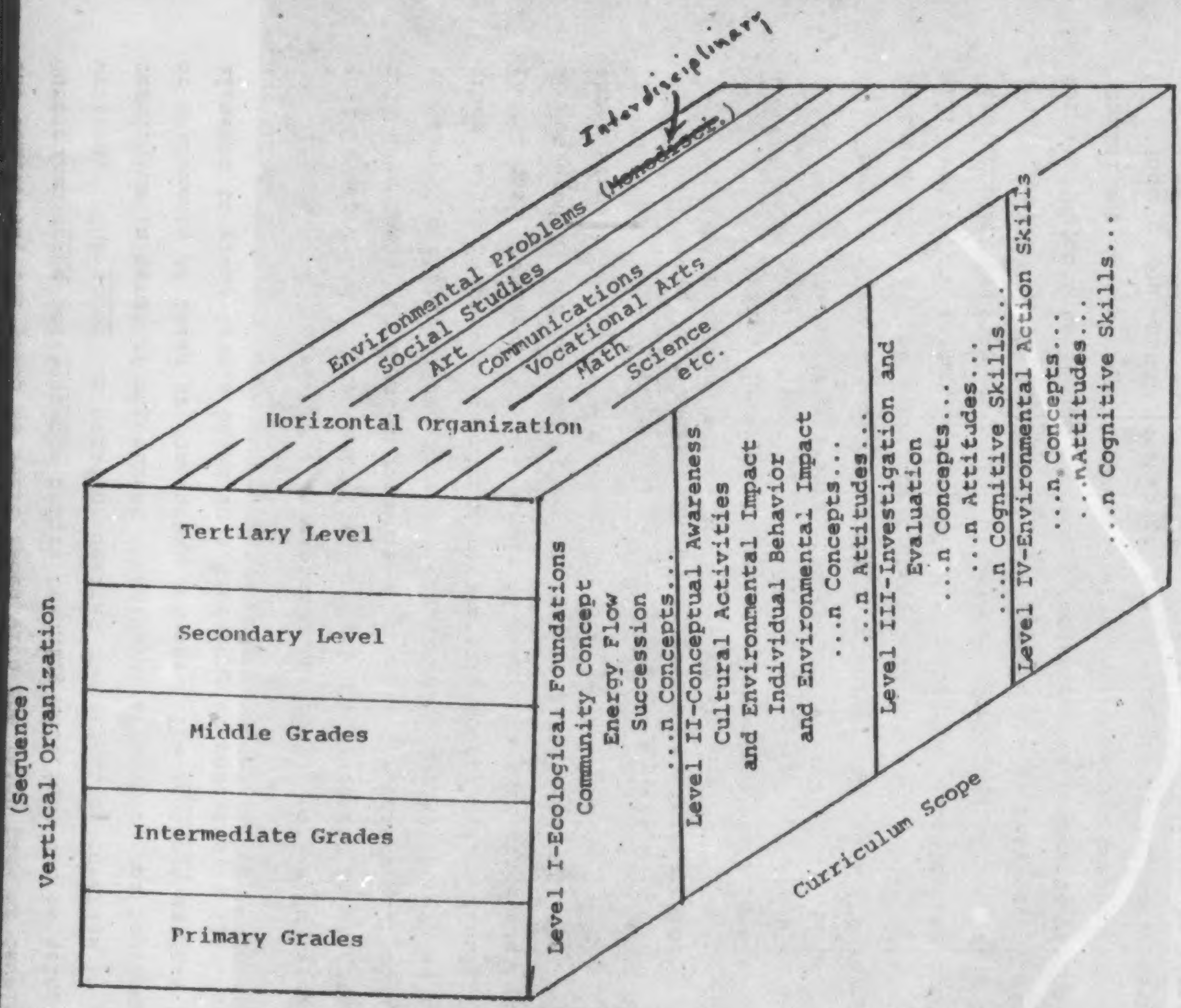
Interdisciplinary
Environmental Problems (~~Monodisc.~~)
Social Studies
Art
Communications
Vocational Arts
Math
Science
etc.
Horizontal Organization
Tertiary Level
Secondary Level
Middle Grades
Intermediate Grades
Primary Grades
(Sequence)
Vertical Organization
Level I-Ecological Foundations
Community Concept
Energy Flow
Succession
...n Concepts...
Level II-Conceptual Awareness
Cultural Activities
and Environmental Impact
Individual Behavior
and Environmental Impact
...n Concepts...
...n Attitudes...
Level III-Investigation and
Evaluation
...n Concepts...
...n Attitudes...
...n Cognitive Skills...
Level IV-Environmental Action Skills
...n Concepts...
...n Attitudes...
...n Cognitive Skills...
Curriculum Scope

Figure 4. A conceptual model illustrating the integration of the curriculum scope through grade levels and across subject areas within grade levels.

be translated into objectives (see Figure 5 which illustrates this procedure) and thence into instructional strategies.[1]

The completed curriculum scope will be an extensive collection of concepts, skills, and attitudes which essentially define the body of the multidisciplinary EE curriculum as perceived by the developers. The bibliography contains references to other curriculum projects which will help the developers in this task of operationalizing the goal level components. These EE curricula have been organized around themes other than those represented by the goal levels in this particular document. However, many serve as excellent sources for specific cognitive and affective curricular components.

It may be appropriate to stress that much work has been accomplished in identifying conceptual, skill, and attitudinal components of EE. The curriculum committee should take advantage of the availability of such materials in its efforts. The primary responsibilities of the team will be in the organization of the curriculum - designing the use of EE materials so they *efficiently* and *effectively infuse* into the existing curriculum according to the needs and constraints of the situation. As the scope is refined, for example, it should begin to reflect the needs and resources of the population for which it is designed by referring to local cultural impacts, environmental resources and issues, etc. Similarly, adaptations of curriculum materials later in the process should be used in order to maximize local situations, needs, and/or issues.

Extreme care should be taken to assure the acquisition and use of sample curriculum models which promote a rational perspective of EE. A vast number of curriculum samples exist. Not all, however, focus on environmental education as defined in this document. Some promote numerous other activities under the

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[1] Some goals will need to be operationalized as guidelines rather than specific instructional objectives. For example, both Levels III and IV of The Goals for Curriculum Development in EE include a Component B which identifies goals of EE to provide receivers with certain *experiences* rather than cognitive or affective instruction per se. These components will be reflected in the scope of the curriculum, but only as guidelines or vehicles appropriate for use in accomplishing those goals in particular school, regional, or national situations. For example (Level III, Component B - Part G), after students have acquired the skills needed for issue investigation and evaluation, the curriculum will provide opportunities for receivers to autonomously choose issues of local, regional, or national significance for investigation under the direction of the instructor. Of course, objectives can be written which relate to the products of this investigation and evaluation. Said objectives can be used to assess student performance or to draw up contracts which provide direction to the students during issue investigation and/or evaluation.

Selected Objectives to Illustrate Scope Development at Four Goal Levels[1]

The examples of objectives provided here are intended to show the specific nature of a partially-developed curriculum scope based on goal levels of the Goals for Curriculum Development in Environmental Education which are described elsewhere in this document. Once the scope of a curriculum is fully developed, components must be assigned to grade levels (vertical organization) and to subject areas within grade levels (horizontal organization).

Goal Level I. Ecological Foundations Level:

Sample Objectives: . . . students will be expected to be able to . . .

1. . . . given a description of population interactions in a community, identify the interaction as predator-prey, competition, or mutualism.

2. . . . diagram the flow of energy through a community by constructing a food chain.

3. . . . Give an example of a successional change in an ecosystem.

Goal Level II. Conceptual Awareness Level - Issues and Values:

Sample Objectives: . . . students will be expected to be able to . . .

1. . . . communicate a definition of the term environment.

2. . . . list at least six interactions that take place between human beings and their environment.

3. . . . prepare and communicate a list of at least ten environmental problems.

Goal Level III. Investigation and Evaluation Level:

Sample Objectives: . . . students will be expected to be able to . . .

1. . . . identify governmental or private agencies to which they can write for specific information about an environmental problem.

2. . . . write a sample letter to an agency asking for information about a particular environmental problem. The letter is to be correct in terms of its general structure, the agency chosen to be contacted, and the kinds of information requested.

3. . . . read two environmental news articles and state at least two differing value positions as expressed in each article.

This figure continued on
next page . . .

4. . . . cite several environmental issue topics which lend themselves to gathering information via surveys.

5. . . . identify those rules which tend to control the effectiveness of survey type strategies.

6. . . . evaluate a completed survey and determine whether the rules governing surveys have been respected.

Goal Level IV. Environmental Action Skills Level - Training/Application.

Sample Objectives: . . . students will be expected to be able to . . .

1. . . . given a specific example of an environmental action, apply the thirteen action analysis criteria listed in Module VI, providing logical answers to each of the thirteen questions.

2. . . . identify a given persuasive action as an emotional appeal, logical appeal, coercion, or combination of these.

3. . . . produce an example of an effective persuasive action on some issue which combines both logical and emotional reasons for taking action and follows appropriate guidelines for persuasive action.

4. . . . describe the dangers of persuasive actions based only on emotion and give one example of an actual environmental issue in which such actions were taken.

5. . . . identify three different modes of persuasion and explain how each can best be put to use.

Figure 5. Selected objectives illustrative of a partially-developed scope for an environmental curriculum.

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1. The objectives seen in this figure are adapted from curriculum material based on the goal levels referred to in this document. The curriculum material is: Hungerford, H. R., Litherland, R. A., Peyton, R. B., & Tomera, A. N. Investigation and Action Skills for Environmental Problem Solving. Urbana, Illinois , Stipes Publishing Company, 1976.

gise of EE including outdoor education,stress challenge programs, nature interpretation, outdoor recreation, etc. The curriculum development team (CDT) must be constantly on the alert to screen out documents which do not fit the parameters of the desired curriculum design.

Once the scope of the curriculum has been developed, it must be sequenced into grade levels. Developing the vertical organization or grade level sequence of the curriculum can be made more effective if the services of curriculum development specialists are available. Special skills and knowledge may be required to make these critical decisions. Consulting other EE curriculum projects which have been found to be effectively designed may also prove valuable.

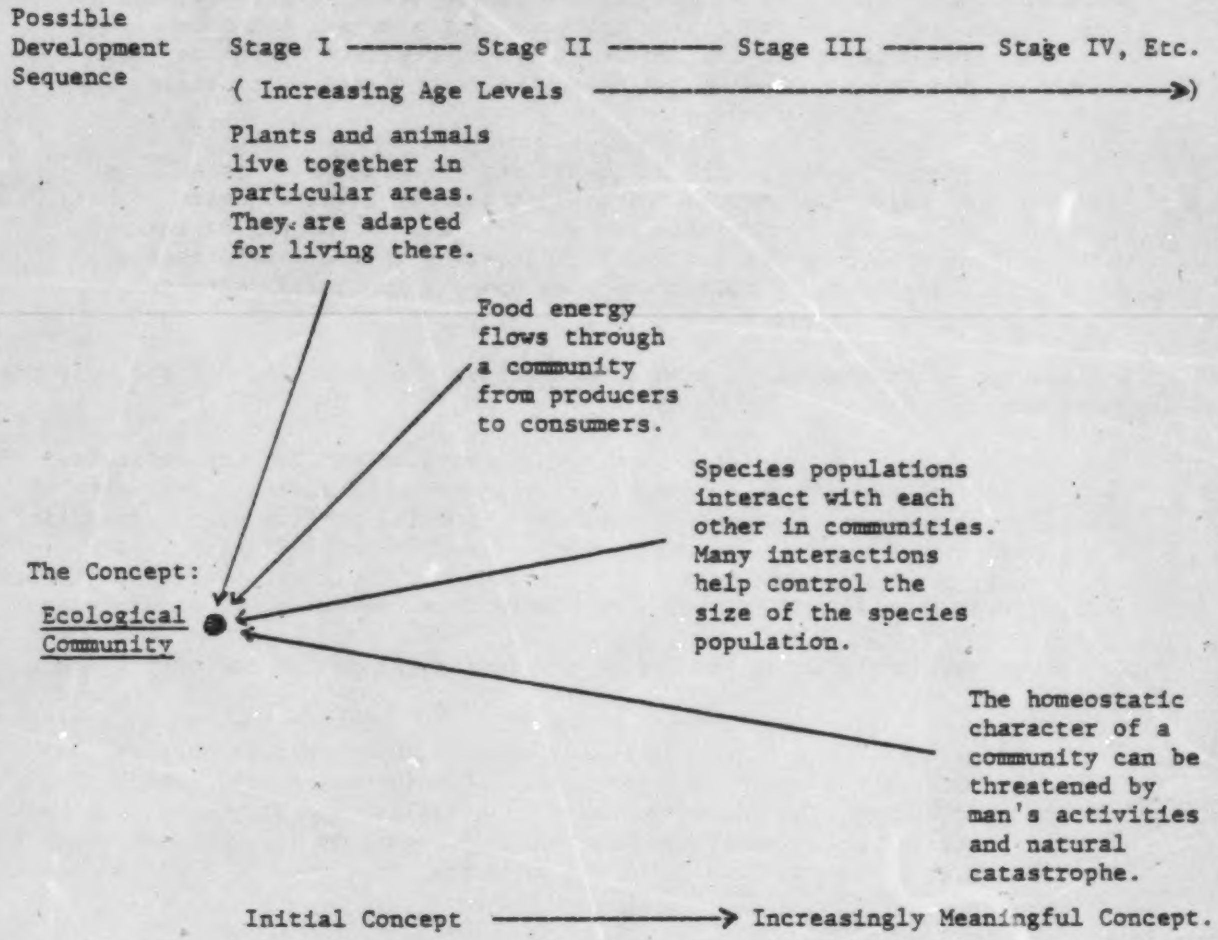
The basis for sequencing the objectives may, in part, be a hierarchy inherent within the scope itself. For example, the curriculum committee may perceive that some elementary concepts of ecology should precede consideration of what constitutes an environmental problem. Similarly, training in the skills of investigation should probably precede the autonomous investigation of issues by students. Similar sequences would occur in citizenship action skills training and other areas.

Another basis for developing the sequence is the application of learning theory. Certain components of the scope may be more appropriate for some receivers than for others. For example, consideration and evaluation of several alternative solutions to environmental problems may be beyond the ability level of a concrete thinker in the primary grades and more appropriate for students capable of developing formal thought patterns. This would be an application of learning theory proposed by Piaget.

A particularly effective strategy in curriculum design is the "spiral approach". In this design, concepts, cognitive skills, and/or attitudes may be spiraled vertically through the curriculum, increasing depth and complexity with successive exposures. Figure 6 provides an example of how the "ecological community concept" might be built vertically through the curriculum.

Horizontal organization involves the assigning of the scope components to appropriate disciplines (content or subject areas) within each grade level. In this task, the committee must use its combined expertise to determine how the EE objectives are related to other disciplines in the curriculum and where they might be most efficiently and effectively accomplished. The content specialists will be familiar with teaching approaches, materials, and objectives in their own disciplines and can identify points at which objectives

Example of Spiral Concept Development



Possible Development Sequence

Stage I -------- Stage II -------- Stage III ------- Stage IV, Etc.

(Increasing Age Levels ——————————————————→)

Plants and animals live together in particular areas. They are adapted for living there.

Food energy flows through a community from producers to consumers.

Species populations interact with each other in communities. Many interactions help control the size of the species population.

The homeostatic character of a community can be threatened by man's activities and natural catastrophe.

The Concept: Ecological Community

Initial Concept ————————→ Increasingly Meaningful Concept.

Fig. 6. Possible spiral development of the ecological community concept in environmental education. Adapted from Hungerford, H. R. and Tomera, A. N.. Science in the Elementary School. Champaign, Illinois, Stipes Publishing Company, 1977. p. 32.

in the infused discipline may parallel, complement or supplement each other.

In assigning EE scope objectives to appropriate subjects within grade levels, it may be useful to consider the following questions:

1. How can existing disciplines be used to accomplish the objectives of EE?

Many learning experiences in the existing curriculum may already be accomplishing the goals of EE and require little or no modification to give these experiences an environmental context. For example, the objectives of a geography unit to provide learners with a knowledge of limited water resources throughout the world may be entirely consistent with those identified in the EE curriculum.

Many other situations will be identified where existing objectives (and teaching materials) may be "environmentalized" to allow needs of both curricula to be met. For example, objectives in math to provide learners with graphing skills may accomodate EE objectives if the data presented for the graphing activity illustrate human population trends throughout the world (or other appropriate data).

2. How can EE objectives be used to accomplish the objectives of the existing curriculum?

The principle of using the knowledge, cognitive skills, and attitudes in a variety of situations to teach for transfer in EE also applies in other disciplines. An investigation of some environmental problem (e.g., dwindling fisheries) which involves learners in objectives from all EE goal levels could also be used to develop and/or reinforce the application of communication skills, math skills, and cognitive knowledge from several other disciplines.

3. How often should EE objectives be reinforced throughout the curriculum?

Achieving either acquisition or transfer of cognitive knowledge, cognitive skills and attitudes is enhanced through repetition. The more complex these components are, the greater need for their inclusion at several points throughout the curriculum. The knowledge, cognitive skills, and attitudes involved in the investigation of environmental problems should be infused into several disciplines at all grade levels (with increasing frequency and depth at higher levels of education).

4. How can infusion be accomplished to maximize use of existing facilities and expertise?

Use of teacher expertise and facilities such as libraries, outdoor laboratories, classrooms, and others may be a consideration in the horizontal organization of the EE curriculum. For example, EE objectives concerned with the knowledge and skills of persuasive action may best be assigned to subject areas taught by teachers with training in communication. Other decisions for horizontal organization may be made based on opportunities for effective team teaching.

5. Are the EE objectives more appropriate for a multi or interdisciplinary model?

When considering higher levels of education (middle school through tertiary levels), it may be more effective and efficient to provide an interdisciplinary experience to accomplish certain EE objectives. Indepth involvement in environmental issue investigation, evaluation and action taking at middle school or higher levels may be such an example.

6. How can EE objectives be infused into the curriculum so that not only sound educational principles of acquisition and transfer be followed, but also so that receivers are able to synthesize their experiences in various disciplines into a meaningful EE context?

The infusion process must not isolate objectives of EE so extensively that the synthesis referred to above does not take place. This implies careful planning and an effective articulation both vertically (through grade levels) and horizontally (assignment to subject areas).

Preparing the EE Curriculum

An analysis of the existing school's program for EE content will have been initiated to some extent during the scope and sequence development phase. This analysis must be continued to identify and evaluate existing school program components (e.g., materials and activities) which achieve EE objectives, or could be modified to accommodate EE objectives. This phase should also identify specific needs for new EE materials and activities to be adapted or developed, and infused into the program.

Once the nature and extent of curriculum preparation needs have been defined as distinct units or lessons, the development committee should assess existing materials resources (such as many of those contained in the bibliography) available for use in the EE curriculum. As discussed earlier, many teaching activities have been developed to achieve EE objectives. Some of the curriculum needs may be accommodated by adapting these materials so they reflect a local emphasis and are consistent with the philosophy, scope and sequence of the EE program being developed.

If the EE curriculum is to provide the receiver with an awareness of the local environment, an inventory and evaluation of available community and regional resources should be made. Such resources may include local sewage treatment plants, land use management projects, area ecosystems, or situations reflecting specific environmental issues (e.g., urban sprawl, land fill areas, channelization projects , wetlands management problems, water pollution sites). Each potential resource should be identified and annotated as to its description, availability, limitations of use (e.g., seasonal usage, number of students permitted, costs involved, distances) and application to the EE curriculum. Further, resources should be inventoried with respect to appropriate program objectives and suggestions for use. The final form of this inventory may be a card file and/or resource manual which may be used by writing teams in adapting or developing learning activities. The inventory should also be made available to instructors once the curriculum has been implemented so that further use of local resources may be made.

The final phases of curriculum preparation involve the writing and adapting of materials and organizing these into a physical format for use by teachers. The exact physical format will be determined by local needs and the characteristics of the program itself.

Continued on next page . . .

Preparation of EE Teachers

The infusion of an effective EE curriculum into existing school programs will necessitate that teachers themselves possess the knowledge, cognitive skills, and affective attributes they are expected to impart to students. They must not only *acquire* these attributes, but do so in a manner that encourages them to *transfer* EE knowledge, skills, and attitudes to their teaching methods. The implications seem quite straightforward: *Classroom teachers should experience training in curricula based on the same criteria as the EE curricula they are expected to teach*.

Following is a set of guidelines for the development of teacher preparation programs. While the opportunities and strategies for utilizing the guidelines differ for inservice and preservice groups, attempts should be made to follow the guidelines in any EE teacher training effort.

The Guidelines

Teacher preparation in EE should . . .

1. . . . focus on and reflect the many-faceted and interdisciplinary nature of EE. In so doing, teachers should be provided with opportunities to acquire and apply the knowledge, skills, and attitudes inherent in environmental education. At the very minimum, this preparation should include:
    - (a) basic training in ecology.
    - (b) field and/or laboratory experiences for teachers in the area of environmental science.
    - (c) knowledge of environmental issues and problems of resource management.
    - (d) competencies in environmental problem identification, investigation, evaluation, and citizenship action.
    - (e) opportunities to develop value clarification skills and knowledge of the roles of human values in environmental issues.
2. . . . provide instruction and experience with EE multidisciplinary (infusion)models curriculum as well as instructional activities and methods similar to those they might utilize in their own classrooms.
3. . . . provide for an opportunity for preservice teachers to experience

a multidisciplinary or infusion model in their own training, i.e., be a receiver in a tertiary infusion model of EE.

4. . . . provide instruction on the philosophy and goals of EE and the nature of interdisciplinary and multidisciplinary (infused) EE curricula. Further, teachers should be trained in the implementation of these models.
5. . . . provide specific training - particularly at the elementary level - in the use of EE content as a vehicle for teaching basic general education skills, e.g., in language arts, reading, and mathematics.
6. . . . provide opportunities for teachers to develop skills in identifying, inventorying, and evaluating local resources for use in environmental education.

Continued next page . . .

Implementing EE Curricula

In many instances, the development of an EE curriculum is easier than its implementation and maintainance in the school. Far too often, a curriculum is placed within a school and, for one reason or another, fails to complete the mission for which it was intended. Similarly and perhaps of even greater importance is the fact that, in many curricular failures, faulty implementation is responsible. In many instances, program failure could easily have been avoided with sound implementation procedures.

Certainly, the exact nature of the implementation process will vary according to the educational structure and character of the school,region, or nation involved. In addition, implementation will be affected by the nature of the curriculum program itself. Considering these problems, it becomes difficult to produce a single set of rules or guidelines for implementation that can be universally applied. However, it remains crucial to develop an implementation strategy that guarantees the successful incorporation of the EE curriculum into the school. Therefore, the writers have chosen to prepare an implementation checklist which will have to be modified to meet the needs of a particular school, region, or nation. This checklist is presented in this section and diagrammed in Figure 7.

The variables associated with implementation can be arbitrarily classified under three headings. These headings are: (1) Program Approval by Inschool Vested Interest Groups; (2) Program Approval by Out-of-School Vested Interest Groups; and, (3) Critical Concomitant Variables. Any implementation agent will probably have to consider all three of these categories in order to maximize the probability of a successful program implementation. In most situations, one finds both inschool and out-of-school groups that have some kind of control over the success of an educational program. These groups must be brought into the implementation process in order to assure their support and approval. Concomitant variables found both within and beyond the school must also be considered and dealt with in order to assure a successful implementation. Of course, concomitant variables will vary with the nature of the program itself and the discrete characteristics of the school, region, or nation in which the implementation process is taking place.

What follows is an implementation checklist, suitable for modification as needed by a particular implementation agent. Spaces have been provided to permit the identification and addition of particular groups and/or variables.

CURRICULUM IMPLEMENTATION VARIABLES

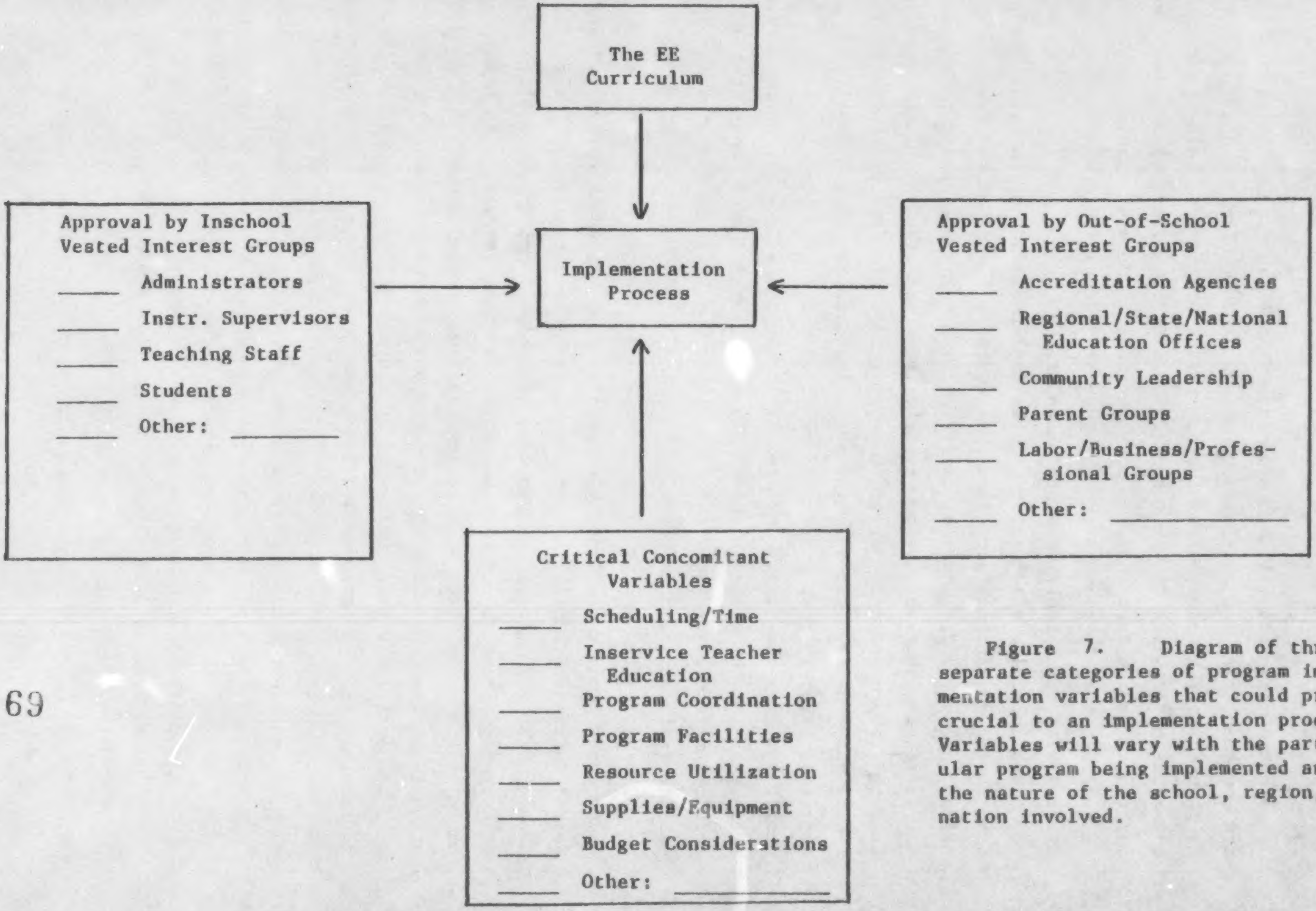

The EE Curriculum
Implementation Process
Approval by Inschool Vested Interest Groups
____ Administrators
____ Instr. Supervisors
____ Teaching Staff
____ Students
____ Other: ________
Approval by Out-of-School Vested Interest Groups
____ Accreditation Agencies
____ Regional/State/National Education Offices
____ Community Leadership
____ Parent Groups
____ Labor/Business/Professional Groups
____ Other: ________
Critical Concomitant Variables
____ Scheduling/Time
____ Inservice Teacher Education
____ Program Coordination
____ Program Facilities
____ Resource Utilization
____ Supplies/Equipment
____ Budget Considerations
____ Other: ________

Figure 7. Diagram of three separate categories of program implementation variables that could prove crucial to an implementation process. Variables will vary with the particular program being implemented and/or the nature of the school, region, or nation involved.

Explanatory comments or questions have been added where necessary for clarification purposes.

The Implementation Checklist

Category I. Approval of Out-of-School Vested Interest Groups.

(Has the implementation agent successfully contacted those out-of-school groups which have direct influence over the success of curricular programs?)

_____ 1. Accreditation Agencies, such as . . .

___ ____

___ ____

___ ____

_____ 2. Regional/State/National Education Offices, such as . . .

___ ____

___ ____

___ ____

_____ 3. Parent Groups, such as . . .

___ ____

___ ____

_____ 4. Community Leadership Groups, such as . . .

___ ____

___ ____

_____ 5. Labor/Business/Professional Groups, such as . . .

___ ____

___ ____

___ ____

_____ 6. Other: ____

_____ 7. Other: ____

Category II. Approval by Inschool Vested Interest Groups.

(Has the implementation agent successfully contacted those inschool groups which have direct influence over the success of curricular programs?)

_____ 1. Administration.

_____ 2. Instructional Supervisors.

_____ 3. Teaching Faculty.

_____ 4. Student Population.

_____ 5. Other: ____

Category III. A Checklist of Critical Concomitant Variables.[1]

_____ 1. Scheduling/Time Considerations.

Problems associated with scheduling vary according to the manner in which the school is organized, educational levels, and the type of curriculum being implemented. Certain kinds of curricula are easier to implement at various grade levels than others. Certainly, a single subject approach is much easier to implement and coordinate than an infused curriculum. In this document, however, an emphasis has been placed on the infusion model due to current worldwide EE thinking. Therefore, scheduling/time considerations will be discussed that relate directly to the infusion-type curriculum.

A number of critical scheduling/time variables must be considered. For example, is time available for the infusion of an EE curriculum into content areas of elementary, self-contained classrooms? If time is a critical consideration, how can schedules be structured to yield sufficient time? Where necessary, how can EE instruction be used to teach basic skills now being taught via some other content vehicle, e.g., reading, language arts, math, and critical thinking skills?[1]

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[1] Many of the so-called concomitant variables are those that are crucial to the total implementation process. They are also ones that should be considered, whenever possible, during the curriculum development process itself. However, this is not always accomplished and, therefore, are described here as part of the implementation process.

In the upper grades where courses are taught on a departmentalized basis, even more critical concerns face the implementation team. If EE content is to be infused throughout the regular curriculum, is every content teacher both willing and able to incorporate the multidisciplinary model? Again, time considerations become critical and problems associated with time must be overcome.

_____ 2. Program Coordination.

Of all the variables impinging on successful implementation, coordination is one of the most critical. Lack of initial and ongoing coordination have led to the demise of many curricular programs throughout the world. Some professional, thoroughly familiar with the curriculum, must be responsible for the coordination of that curriculum. This premise is even more crucial when the curriculum is based on multidisciplinary-type model. Not only must the coordinator have expertise with the program, he/she must also be given the time and authority needed to accomplish the many tasks associated with coordination. Additionally, the coordinator must have considerable rapport with the instructional staff in order to accomplish the coordination mission.

_____ 3. Initial and Ongoing Inservice Teacher Education.

This is one of the most critical of all implementation variables. However, it is discussed elsewhere in this document and will not be discussed further here.

_____ 4. Facilities.

In a curriculum where certain inschool and out-of-school facilities are critical to the success of the program, consideration for same must be given as early as possible in the implementation process. Are the facilities adequate? How do they relate to the curriculum? If facilities are not adequate, can either the facilities or the curriculum be revised to make implementation successful.

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[1] It appears cogent to consider the very real possibility that, if curriculum developers intend for elementary teachers to use EE activities to teach basic skills, these same teachers must be trained in both the content and methods involved in this process. A recent research study deals with this topic as it relates to elementary science instruction: "Improving Elementary Teachers' Use of Science as a Content Vehicle for Language Arts Instruction." Occasional Papers in Language and Reading. (December 1979) School of Education, Indiana University, Bloomington, Indiana 47405.

_____ 5. Resource Utilization.

Allied to facilities is a variable that is sometimes overlooked during environmental program implementation - that of resource utilization. In those EE programs calling for direct interaction between students and out-of-school (or even inschool) resources, consideration must be given to whether said resources can be utilized in a manner as to safeguard those resources. It is often inappropriate, for example, to place a great deal of stress on an environmentally-related establishment or facility, e.g., a family planning agency, city park, nature center, etc. Implementation agents should consider whether the planned student-resource ratio is appropriate to a given resource. An environmentally-related agency must not be expected to spend the majority of its time meeting the needs of a particular curriculum.

Interestingly, some environmentally-oriented curricula have been found to be detrimental to resources being used. A particularly small ecosystem is especially liable when it comes to overutilization. Too, some ecosystems - even large ones - are very sensitive to human use and abuse. It is totally inappropriate for a program purporting to support and maintain the environment to find itself degrading that same environment.

_____ 6. Materials and Equipment.

The question of whether a school has appropriate materials and equipment to implement a curriculum is very important. What happens in a program calling for the duplication of large numbers of worksheets in a school where duplicating supplies are always in short supply? What of laboratory equipment and supplies in the upper grades? Are they suitable? In a multidisciplinary programme these questions must be asked of a number of content areas besides science, e.g., home economics.

_____ 7. Budget.

Does the curriculum call for either an initial investment of monies or an ongoing investment or both? If so, is the money available? If not, can it be made available? Again, can the curriculum be revised to meet budgetary constraints if this proves necessary?

Comprehensive EE Curriculum Evaluation

By and large, in today's education systems, curriculum evaluation consists mostly of observations directed toward an assessment of how well students meet particular objectives or sets of objectives. Certainly, this is one facet of curriculum or product evaluation. However, it is only a small part of what should be included in the total evaluation process.

In evaluating EE curriculum programs, a comprehensive evaluation strategy should be utilized. This kind of evaluation model is partly diagrammed in Fig. 8. A thoroughly comprehensive evaluation will go beyond even those components shown in Fig. 8. As an example, a critically important aspect of curriculum evaluation is the determination of whether the curriculum has internal consistency, i.e., are goals, objectives, instructional procedures, and student evaluation strategies consistent with each other? This consistency or interrelation has been diagrammed for the reader in Fig. 3 on page 26 of this document.[1] This area of evaluation should begin even during the curriculum development process and continue into and beyond initial implementation phases. It is not accomplished easily in that consistency evaluation is largely a judgment-related procedure. Whether goals, objectives, instruction, and student evaluation maintain high internal consistency must be judged - at least initially - on a subjective basis. Everyone concerned with curriculum development and implementation should be constantly attuned to this evaluation need and participate in it. It is also highly appropriate to bring in a professional and competent consultant or consultant team to analyze the curriculum from this standpoint. Any inconsistencies should be immediately noted with the curriculum subsequently revised.

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1. The reader may wish to see an example of internal consistency as related to an EE curriculum. Recalling Level IV, Component A of the Goals for Curriculum Development seen earlier in this chapter, one notes that this goal relates directly to receivers having the skills needed to take environmental action . . . . One would expect that students would somehow be evaluated on their ability to apply one or more of these skills. However, if the student is evaluated solely on whether he/she can define the modes of action and identify issues on which those modes could be applied, the evaluation falls far short of the goal. In order for the goal to be attained, the student would have to be observed applying those skills in at least a surrogate, role-playing situation. Anything less than this is truly inadequate and inconsistent with the desired terminal behavior.

CURRICULUM EVALUATION

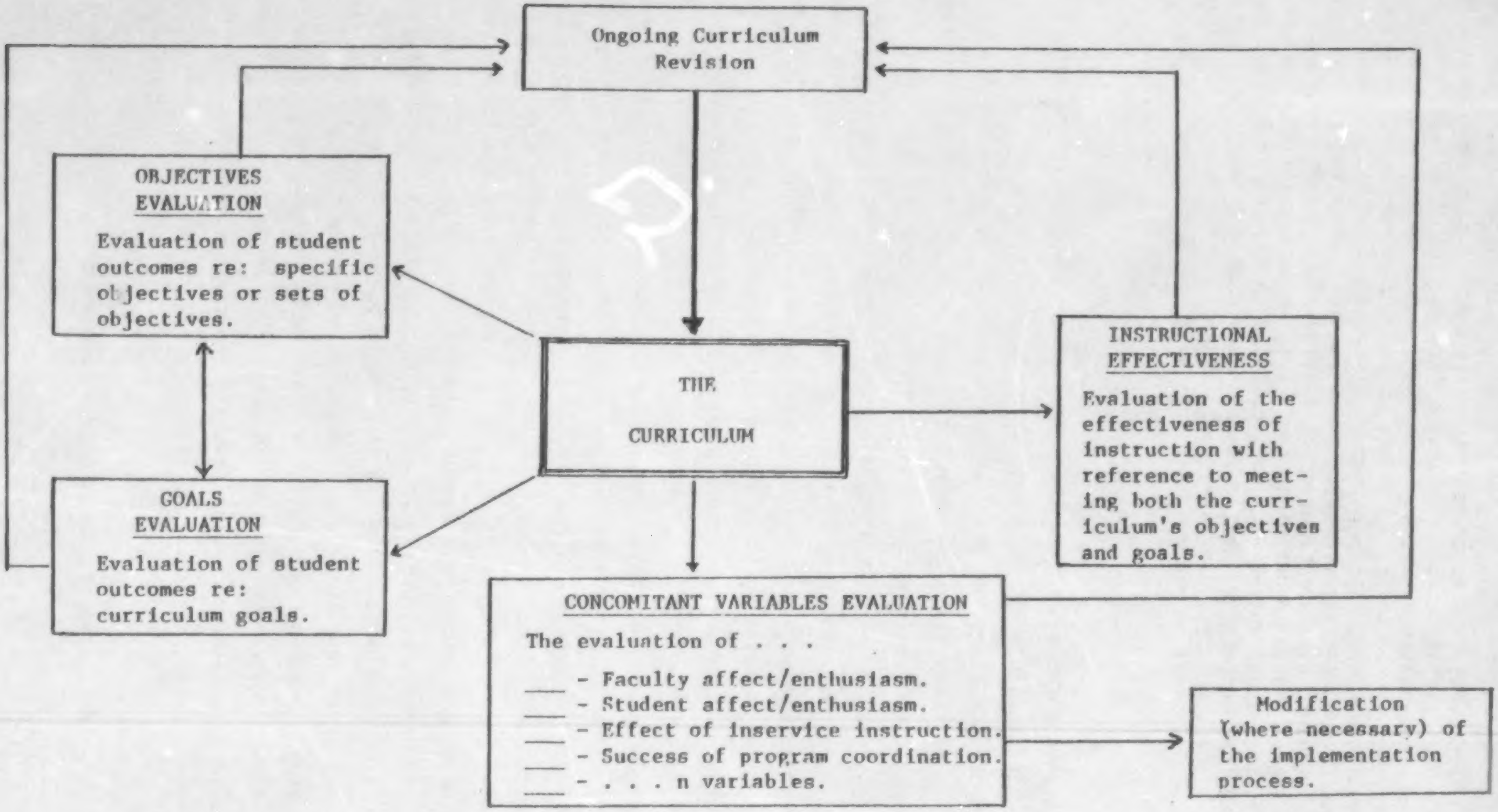

Ongoing Curriculum Revision
OBJECTIVES EVALUATION
Evaluation of student outcomes re: specific objectives or sets of objectives.
THE CURRICULUM
INSTRUCTIONAL EFFECTIVENESS
Evaluation of the effectiveness of instruction with reference to meeting both the curriculum's objectives and goals.
GOALS EVALUATION
Evaluation of student outcomes re: curriculum goals.
CONCOMITANT VARIABLES EVALUATION
The evaluation of . . .
___ - Faculty affect/enthusiasm.
___ - Student affect/enthusiasm.
___ - Effect of inservice instruction.
___ - Success of program coordination.
___ - . . . n variables.
Modification (where necessary) of the implementation process.

Fig. 8. Schematic Diagram of Curriculum Evaluation. Curriculum evaluation must be thought of as an ongoing, continual process. It must be both formative and summative in nature, focusing on the consistency of all elements and their interrelationships. Above all, evaluation must not be simply an investigation into the extent to which students are meeting desired objectives and goals. In order to be maximally effective, it must also include the evaluation of the instructional process and those concomitant variables so often considered basic to the curriculum implementation process.

Measurement in the Evaluation Process

The degree to which students are achieving the objectives for a particular lesson, unit, or module is certainly an appropriate consideration as part of the evaluation process. Assessing this acquisition of objectives is oftentimes dependent on some form of measurement. Measurement, in the scientific sense, is the process used to determine the degree to which receivers reflect particular desired behaviors or characteristics. Thus, if one wishes to measure the extent to which students are involved in citizenship action with respect to environmental issues, the professional must devise some sort of measurement device to assess this trait. In the case of environmental action, direct observation would probably be the most valid source of information. However, since environmental action is a behavior that should be autonomously applied (in most instances), direct observation by the educator is usually impossible due to the enormous expenditure of time and energy it would necessitate. Therefore, the educator turns to some other measurement source for his/her information. A number of possibilities exist. The educator could use a self-reporting instrument which has receivers report the types of action taken (if any) and the number of times these actions were taken. Or, parents can act as data sources and report environmental action behavior (via a questionnaire) as they have observed it in and around the home and community. Both of these strategies have been successfully used in certain instances by the writers. Whenever self-reporting or second-party reporting are used, some safeguard needs to be incorporated to help assure that the results will be as valid as possible. Even with validity concerns present, the second-party strategy may be the only alternative. In any event, these data collection mechanisms constitute the measurement phase of evaluation.

Using environmental action data as a source of information about the action behaviors of receivers, one can make judgments about the effectiveness of the curriculum in meeting one of the major goals on which the curriculum was based. This judgment or decision is, in effect, evaluation. Evaluation is, to a great extent, a value judgment based on the extent to which certain objectives have been met and the relation of these objectives to one or more curricular goals.

Measurement, then, becomes the process of data collection which is, in turn, an integral phase of evaluation. The two terms are not synonymous but they are certainly related.

Comprehensive Evaluation and Concomitant Variables [1]

In a comprehensive evaluation of curriculum, there exists a need to evaluate much more than the extent to which instruction is effective and the degree to which receivers are acquiring the behaviors associated with the curriculum's objectives and goals.

The functional environmental education curriculum is likely to prove to be a comprehensive set of goals, objectives, instructional procedures, and student evaluation mechanisms extending across a wide range of age (grade) levels. In so being, it may also be a plethora of interactions existing between curriculum developers, implementors, coordinators, administrators, teachers, students, parents, budgets, materials, and curricular-related resources. Many of these interactions are tangibles and can be dealt with fairly easily, e.g., the longevity of materials and equipment, unpredicted budget difficulties, etc. Many of these interactions are, however, ones which involve personal attitudes, values, and concerns. What is the acceptance level of the faculty? What is their attitude toward the curriculum? How enthusiastic are they? If problems exist, could steps be taken to resolve them? Should these steps be ones related to implementation? The curriculum itself? How can these new strategies be assessed? . . . and many others!

Whether the comprehensive evaluation strategy seems unwieldly will depend upon the thought going into it initially. As noted earlier, critical concomitant variables associated with implementation should be considered early in curriculum development. The same holds true for these variables and how they relate to evaluation since each and every concomitant variable related to implementation should also be evaluated. Many of these variables were diagrammed and discussed under the section dealing with implementation. An exhaustive list is not possible here simply because these variables are closely allied to and defined by the educational system of the school, region, or nation undergoing curricular change. The appeal here, then, is for the

---

1. In a document such as this it is as impossible to focus on all aspects of evaluation as it is to suggest a standard curriculum for every school, region, or nation. Numerous topics such as behavioral research strategies, summative and formative evaluation strategies, standards for product evaluation, testing, etc. may well eventually have to be addressed by the evaluator(s). These topics can be better understood by turning to a good reference book - some of which are found in the bibliography of this document. These topics can also be addressed by a competent evaluation consultant or consultant team.

curriculum development/implementation/evaluation team(s) to carefully analyze the entire process in light of the conditions peculiar to its/their situation. The major responsibility for a comprehensive evaluation lies with the professionals involved in the entire process. The success or failure of the curriculum may well depend on how well these professionals accomplish this task.

CHAPTER IV

SUMMARY/CONCLUSIONS

Chapter I of this document presented a terse needs-statement concerning environmental education curriculum development, an authors' task-statement, and suggestions for the use of materials presented herein. Chapter II briefly traced the roots of EE, summarized UNESCO-UNEP's research findings concerning the status of world-wide EE curricula, and compared current program offerings with the challenge presented by the Tbilisi Declaration. Above all, Chapter II emphasized the need to bring EE curriculum to maturity by providing for training in citizenship participation, i.e., environmental action.

Chapter III attempted to identify the major steps for initiating the development of an EE curriculum, and to suggest strategies and/or guidelines for executing the developmental stages. The flow chart found in this chapter has been prepared to help the reader conceptualize these strategies as an overall curriculum development process.

The strategies and guidelines discussed in this document have adhered to the trends and goals for EE identified by the Intergovernmental Conference on Environmental Education (Tbilisi, USSR, 1977). A summary of the major principles, strategies, and guidelines (of Chapter III) is presented as follows:

1. Formats for EE curriculum design may be either of an inter- or multi- disciplinary (infusion) approach. Both approaches have utility in a comprehensive K-12 (or higher) curriculum and should be selected for use where most appropriate (see Table I, pages 13-14).

2. EE must provide not only for the acquisition of knowledge, cognitive skills and attitudes, but for their transfer to decision making by recievers. Thus the content, sequencing, and teaching strategies encompassed by an EE curriculum must reflect appropriate principles of learning and cognitive development.

3. The content, sequencing, and teaching strategies of the EE curriculum should reflect the priorities established by world-wide, professional environmental educators.

4. The criteria for decision making in environmental education are inherent in operational goal levels (e.g., Goals for Curriculum Development in Environmental Education). Selection of objectives, content, and teaching strategies

THE EE CURRICULUM DEVELOPMENT PROCESS

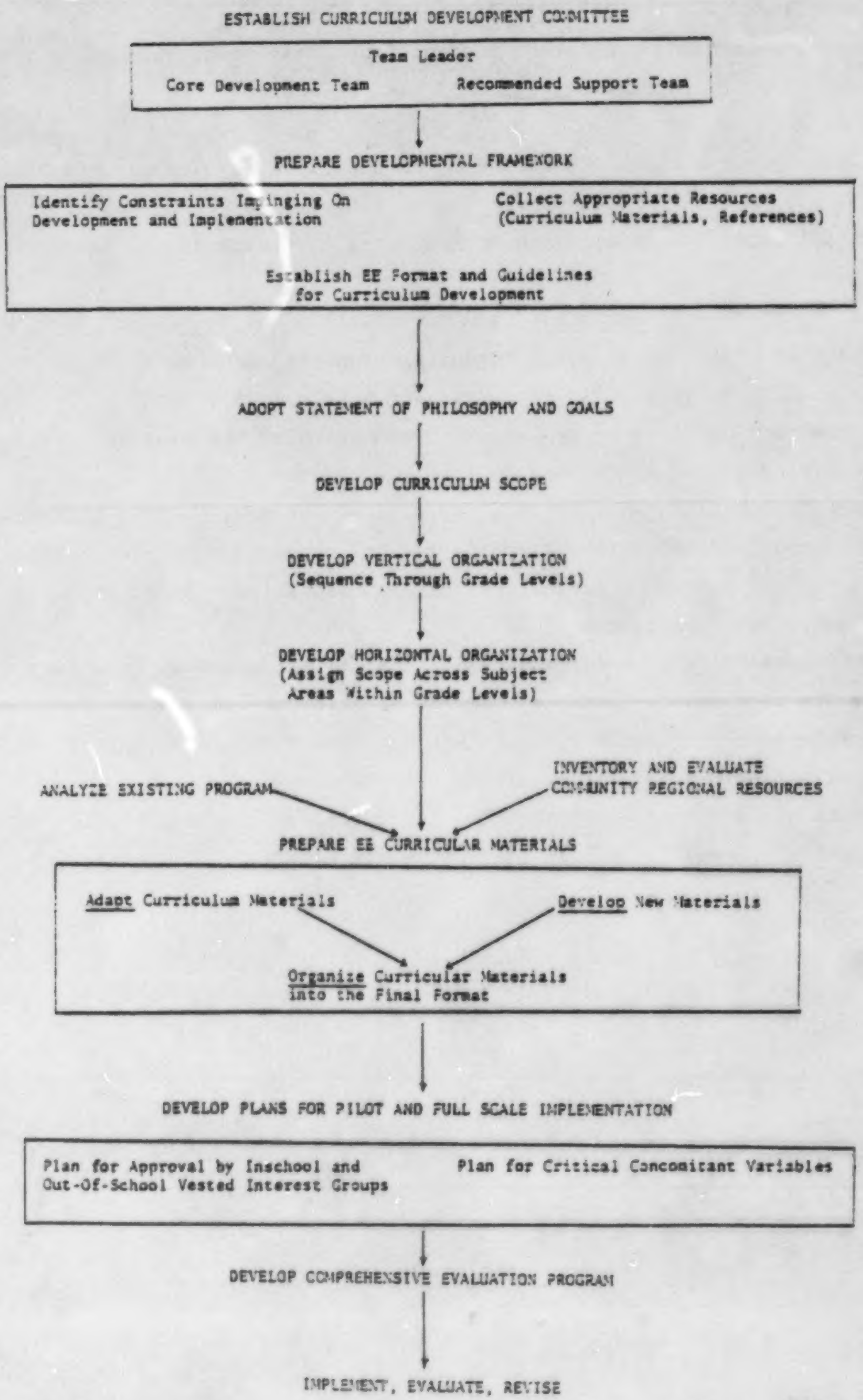

ESTABLISH CURRICULUM DEVELOPMENT COMMITTEE
Team Leader
Core Development Team
Recommended Support Team
PREPARE DEVELOPMENTAL FRAMEWORK
Identify Constraints Impinging On Development and Implementation
Collect Appropriate Resources (Curriculum Materials, References)
Establish EE Format and Guidelines for Curriculum Development
ADOPT STATEMENT OF PHILOSOPHY AND GOALS
DEVELOP CURRICULUM SCOPE
DEVELOP VERTICAL ORGANIZATION (Sequence Through Grade Levels)
DEVELOP HORIZONTAL ORGANIZATION (Assign Scope Across Subject Areas Within Grade Levels)
ANALYZE EXISTING PROGRAM
INVENTORY AND EVALUATE COMMUNITY REGIONAL RESOURCES
PREPARE EE CURRICULAR MATERIALS
Adapt Curriculum Materials
Develop New Materials
Organize Curricular Materials into the Final Format
DEVELOP PLANS FOR PILOT AND FULL SCALE IMPLEMENTATION
Plan for Approval by Inschool and Out-Of-School Vested Interest Groups
Plan for Critical Concomitant Variables
DEVELOP COMPREHENSIVE EVALUATION PROGRAM
IMPLEMENT, EVALUATE, REVISE

Figure 9

must be consistent with these operational levels.

5. A proven, internally consistent instructional model must be used in the development of EE curricular materials if desired outcomes are to be achieved and evaluated.

6. The development and implementation of an effective EE curriculum will requre the combined efforts and expertise of internal (e.g., in-school) personnel supported by consultation with external consultants and resource people.

7. Since "teacher-proof curricula" are not possible and few extant pre-service teacher education programs adequately prepare teachers to adapt and/or utilize EE materials, an EE curriculum development project must consider the need for in-service teacher training. The training program should reflect accepted guidelines to maximize efforts.

8. Implementation plans must provide for program approval by both inschool and out-of-school vested interest groups and for other critical concomitant variables such as program coordination, program facilities, resource utilization, and budget considerations.

9. A comprehensive program for evaluating the EE curriculum is necessary to determine the need for revision in order to achieve program goals. Components of a comprehensive evaluation plan include evaluation of goals, objectives, concomitant variables, and instructional effectiveness.

10. Results of EE curriculum evaluation may result in the modification of the implementation process as well as the curriculum itself.

END

APPENDIX A

SAMPLE ACTIVITIES (MODELS) BASED ON THE INFUSION PROCESS AND THE GOALS FOR CURRICULUM DEVELOPMENT FOUND IN THIS DOCUMENT

APPENDIX A

Sample Activities (Models) Based on the Infusion Process and the Goals for Curriculum Development Found in This Document

Sample Activity I - Ages 6-8

Toothpick Worms - Protective Coloration

Curriculum Goals - Level I
Ecological Foundations Level

Goal: . . . ecological knowledge . . .
individuals (Part A).

Ages: 6 - 8.

Content Area: Science

Instructional Objectives:

Upon or during completion of the activity called "Toothpick Worms" students will be expected to be able to . . .

1. . . . report the number of "worms" preyed upon by color.

2. . . . suggest a logical rationale for the discrepancy observed when equal numbers of worms (by color) were not retrieved.

3. . . . explain the advantages and disadvantages (to the prey organism) of being a particular color in the environment in which the activity took place.

4. . . . name at least two locally observed organisms which are protected from predation by color.

5. . . . explain how protective coloration enables the organism named in No. 4 above to survive predation.

(Note: These objectives are not exhaustive for this lesson. This lesson can be adapted and used with more mature receiver groups. The writers have developed a lesson, based on this activity, for use with inservice elementary teachers.)

Instruction:

Preparation: Prepare for this activity by dyeing at least 250 toothpicks with food coloring. Fifty should be dyed green. fifty yellow, fifty brown, fifty red, and fifty blue. An additional 50 should be left the original wood color and used along with the dyed toothpicks. Total = 300. (Colored yarn may be substituted for dyed toothpicks.)

Select an area outside at least 20 meters square. This area should be a grassy one but the vegetation need not be a rich green. Any color soil will probably be effective.

The 300 toothpicks should be thoroughly mixed and randomly distributed over the chosen area. This scattering of toothpicks should be accomplished without the children being present.

The activity: Explain to the children that they are going on a worm hunt. Tell them that you know of an area where there are green, yellow, brown, red, blue, and wood-colored worms. Ask three or four of the children to volunteer to hunt the worms. Explain to the remainder of the group that the worm hunters will have two minutes to collect as many of the worms as possible and that the class will observe the worm hunt.

Take the observer children to the worm hunt area. Distribute them around the perimeter of the area and establish boundaries. Then, bring the worm hunters to the area and give them instructions once again. Have them hunt worms for two minutes.

After the worm hunters are finished, have the class see how many of the remaining toothpick worms they can find. Of course, keep the worms collected during the two minute hunt separate.

Return to the classroom. Count the originally retrieved worms by color. Record on the board the number of each color retrieved. Ask the children how different the totals are. Ask if they can explain why the differences exist (making certain that all children understand this concept before leaving it). Ask the children if they can identify those colors which would be a distinct disadvantage to worms living in that area. Ask which would have the biggest survival advantage.

Ask the children if they know of animals in the area which are helped to survive because of their color. If the children do poorly with this discussion the instructor could return to the outdoors with the children and actually search for organisms (e.g., insects) which are protectively colored. If this cannot be accomplished, the instructor can name several common animals that are adapted for survival because of coloration. A discussion should follow which focuses on why this coloration protects the organism.

The discussion should progress to the point where the children understand that not all organisms are color-protected for survival. If the children can grasp the idea that protective coloration increases the chances that a number of individuals will survive to reproduce, excellent! This will provide a beginning for the development of the concepts associated with "species population".

Evaluation:

The evaluation of the objectives can be done in a number of ways. An excellent way is to wait a day and then reintroduce the topic of protective coloration and its survival benefits. Questions remaining can be answered.

The children can be orally questioned or, if mature enough to write sentences, they can respond on a duplicated evaluation handout. The following questions will measure the acquisition of the objectives:

(1) Which color toothpick worm was the hardest to see in the outdoor environment:

Green ______ Brown ______

Blue ______ Yellow ______

Red ______ Wood-Color ______

(2) Write a sentence telling why this color was the hardest one to see.

> (Note: If the evaluation is accomplished orally, simply transpose the statement to a question and ask it of the children. Similarly, all of the evaluation tasks that follow can be transposed into an oral evaluation format.)

(3) Write a sentence telling why it is important for some animals to be protected by color.

(4) Write the names of two animals that live in our area that are protected by color.

(5) Go back to No. 4 and circle the name of one of the animals you wrote down. Now, write a sentence telling how this animal's color helps it survive.

Sample II - Ages 9-11

Making Decisions About Electrical Appliances

Curriculum Goals - Level III
Investigation and Evaluation Level

Goal: . . . identify and clarify their own value positions . . . (Part E).

Ages: 9 - 11 (and higher).

Content Area: Science, Social Studies, Home Economics, and others.

(Note: This activity, like so many others in EE, is probably better used in a developmental situation rather than an episodic one. The activity could well be incorporated into a unit or module related primarily to Goal Level II - Parts A or B. Another focus such as an introduction to values clarification could provide the developmental focus. The important point here is that an activity such as this could be used in a number of different situations for a number of reasons. The writers have arbitrarily chosen to focus here on Goal Level III - Part E.)

Instructional Objectives:

Upon or during completion of the activity related to electrical appliances, students will be expected to be able to . . .

1. . . . identify electrical appliances found in their homes and record decisions concerning which of those they could do without completely and which, if any, they are totally dependent on.

2. . . . infer (orally or otherwise) why people have appliances in their homes which are really not necessary.

3. . . . identify those appliances they value highly and explain why they decided to value these appliances to such a great extent. In addition, students will be able to analyze their values in terms of quality of life as compared to the impact of these values on the environment.

4. . . . explain why man's present culture is so largely dependent on the consumption of electrical energy.

5. . . . engage in a dialogue with fellow students on the need for and/or the value of certain electrical appliances. (This dialogue should impinge heavily on the values clarification process, particularly as students think through their own values and publicly affirm those which they feel willing to act on.)

6. . . . make tentative decisions concerning whether or not significant amounts of electricity could be conserved if a community-wide effort was employed to modify the use of electrical appliances.

(Note: These objectives are not exhaustive for this activity. Other objectives could be written for particular purposes and/or age groups. The ones seen here are simply examples of those that could yield productive results in many classrooms.)

Instructions:

Preparation for this activity will depend largely on the context in which it is being used, i.e., whether used as an activity in an energy unit, values clarification unit, issue investigation unit, etc. The instructor must make a decision about when the activity should be incorporated to maximize its effectiveness. (Or, the curriculum developer(s) should determine when it should be utilized in a particular scope and sequence.)

The activity can be duplicated so that each student has a copy as a work sheet. At the appropriate time, the work sheets can be distributed.

It is extremely important for the instructor to facilitate discussion after the initial inventory has been completed. A number of discussion questions appear at the end of the inventory. Other questions can be generated by referring to the objectives. In most instances the instructor should ask students to communicate the bases for their value decisions - to tell why they answered as they did. In this manner the student's rationale can be inferred and evaluated.

Work Sheet

Making Decisions About Electrical Appliances

In this activity, you are asked to think about your home and write down ten (10) electrical appliances found there. After writing these down, you will be asked to make some hard decisions concerning their use. Write the names of the appliances in the table that follows and then read on for further instructions.

Code			The Item	Value Highly
W	E			
		1.	Television set. (One example)	
		2.		
		3.		
		4.		
		5.		

(Note: Continue until ten spaces are provided.)

Now, go back and decide which of the appliances you could do without completely. For those you could do without completely, place a check (✓) under the column marked "W". When you have done this, go back over the list and decide how many of the remainder you could do without during a power emergency. For these, place a check (✓) under the column marked "E". Finally, go back over the list and decide which of these appliances you value highly for use in your own life. For these, place a check (✓) in the column headed by "Value Highly".

Some Questions for You to Consider:

1. Look closely at the appliances you checked that you value highly. Could any of these be consuming amounts of energy that are too great when we are in the middle of an energy crisis? If so, which ones?

2. Why do you think that people have appliances in their homes which are really not necessary for personal health or survival?

3. Which, if any, of the appliances in your list are extremely important in terms of staying alive or healthy? Why is this the case? If ALL energy was shut off during a natural disaster, could you survive without these appliances? Why? Why not?

4. Man uses a tremendous amount of electrical energy today. Why does man depend so much on electrical energy?

5. Do you think that large amounts of electrical energy could be conserved in your home or in the community as a whole? If so, how could this be accomplished? Can you think of a plan that might work? How would you go about getting such a plan into practice?

End of Work Sheet

Evaluation:

Activities which are largely values clarification activities are difficult to evaluate, even with the use of instructional objectives. Ethical considerations preclude evaluating students' values against those deemed worthy by the instructor. Therefore, students must be evaluated, instead, on the processes involved *in* values clarification including the students' rationales for values held or under development.

The instructor must also be aware that some students may come from homes which live a very parsimonious existence with respect to the consumption of electricity. If these students already have values consistent with energy conservation and act on these values, little values clarification may actually take place as a result of an activity such as this one. If this is the case, these students must not be penalized simply because they have a set of entry values consistent with a thorough respect for the environment.

Evaluation remains, however, an important consideration for the teacher.

Referring back to the instructional objectives, evaluation suggestions follow:

1. Does the student identify appliances found in the home? Is the student able to identify those which are absolutely necessary and those that could be deleted without negatively influencing a quality of life?

2. Is the student able to identify the cultural influences which promote having an increasing number of appliances in the home, e.g., advertising?

3. Can the student communicate a rationale for his/her values concerning those appliances highly valued? Is the rationale one related to actual survival/need or is it related to a consumptive life style? Is the student able to communicate the extent to which his/her life style is consistent with maintaining a quality environment?

4. Is the student able to identify variables which contribute to intensive electrical consumption in the culture, e.g., electric heating, industrialization, business remaining open after dark, etc.?

5. To what extent does the student participate in a dialogue with classmates concerning the need for and/or the value of certain electrical appliances? Does it appear that the student's dialogue is rational and based on carefully thought out values? Or, does it appear as though the student's values are being clarified as a result of an ongoing dialogue?

6. Can students prepare a plan whereby significant amounts of electrical energy could be conserved in the home and/or in the community? Can they offer suggestions for implementing such a plan?

The instructor may wish to employ a check list for recording his/her impressions of students' reactions to the above. This check list could be in a yes-no format for some items or employ instructor-determined point values which would reflect the quality or number of responses. A number of possibilities exist for engaging in the evaluation process.

Regardless of the evaluation mechanism employed, the instructor should always look at the consequences of instruction to help determine whether the act of instruction was effective. In this manner, decisions concerning revision and/or the modification of methods can be made.

Sample III - Ages 12-15

Consumer Product Need and Environmental Cost Assessment

Curriculum Goals - Level III
Investigation and Evaluation Level

Goal: . . . analyze environmental issues and the associated value perspectives . . . (Part B).

Ages: 12-15

Content Area: Social Studies, Home Economics, and others.

Instructional Objectives:

Upon or during completion of the product need and environmental costs assessment activity, students will be expected to be able to . . .

1. . . . state six questions (criteria) which must be answered to assess the environmental impact of a product.

2. . . . state three considerations (criteria) to be made in assessing the need of a product.

3. . . . apply the criteria of product need and environmental cost to a product which he/she consumes, and give reasons for the final assessment decision.

4. . . . explain the roles of information (knowledge) and values (feelings) in determining the product need and environmental cost.

5. . . . identify, locate and utilize reliable sources in making a thorough search for information needed in the application of environmental cost criteria.

6. . . . based on his/her own product assessment, identify at least three alternative actions concerning the product for further evaluation (e.g. boycott, conservative use, substitution).

---

[1] This activity from Hungerford, H. R. et al. Investigation and Action Skills for Environmental Problem Solving. Urbana, Illinois, Stipes Publishing Co., 1978.

Instructions:

The specific approach to be used here depends upon the context of the activites used. However, several basic guidelines may be described to make the learning experience effective. For purposes of this discussion, assume the activity is being used in a middle school social studies class, which has been involved in the study of cultural impact in the environment.

The approach taken here is to present students with an overall concept, then model the criteria to be applied, and finally allow students to apply the criteria to a product of their own choosing. The activity might also be used in an inquiry (inductive) mode which would allow large or small groups to generate their own criteria as well as apply them to products. In the approach used here, the following student materials should be prepared and distributed. When students have interacted with the reading and activity, the materials should be discussed to prepare students to achieve objectives 3, 4, 5, and 6. Finally, students (individually or in small groups) will identify their own product for assessment and apply the criteria.

Student Materials

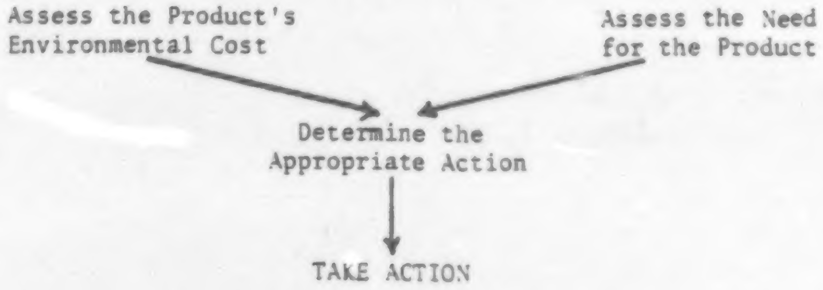
Consumer Product Need and Environmental Cost Assessment

As consumers of services and products, we take consumer actions every day which affect our environment. Consider the following list of products. Most of these you probably use at least occasionally.

1. soft drinks (pop) in disposable cans
2. electric hair dryers
3. plastic sandwich bags
4. automobiles
5. refrigerators
6. hamburgers in disposable containers

Certainly, you could add many other products to this list. Are the effects of these products on the environment negative or positive?

Actually, it is nearly impossible to classify a product as completely good or bad for the environment. Instead, a comparison must be made between the harmful effect the product has on the environment (ENVIRONMENTAL COST) and the NEED for the product. The flow chart which follows suggests an approach which can help in selecting a positive consumer action.


Assess the Product's Environmental Cost
Assess the Need for the Product
Determine the Appropriate Action
TAKE ACTION

Assessing Environmental Costs of Products

Assessing the damage a product may do to the environment is not an easy task. To help in making an assessment of environmental cost, a list of questions is presented below. Consider each of these. As an example of how the questions may be used, they are applied to the disposable pop can.

1. Is the product made from natural resources which cannot be renewed?

> FOR POP CANS: Pop cans require a number of metals in their manufacture. Since metals cannot be replaced once they are mined from the earth, the answer is definitely YES, they do require non-renewable resources.

2. When the natural resource (or product) is taken from the environment, does it change the environment in any permanent and undesirable way (damage the environment)?

> FOR POP CANS: Metal for producing cans must be mined. Mining operations always have a measurable effect on the environment. The wastes produced by the mine may pollute water ways; the earth is often scarred permanently. Of course, there is also the matter of the energy it takes to remove minerals from the earth.

3. If the change (damage) is not permanent and can be repaired, is it being repaired?

> FOR POP CANS: Unfortunately, much of the damage remains because repair (recovering the mined land and cleaning polluted waters) is so expensive.

4. Does the manufacture, transport, and/or storage of the product damage the environment?

> FOR POP CANS: The transport of canned pop is no more destructive to the environment than transport of bottles. However, the manufacture of pop cans causes pollution - air as well as water - and uses tremendous amounts of energy. This is especially significant, since the can is intended to be used only once.
>
> In 1971, the energy involved in making and transporting pop (and beer) containers exceeded the combined energy needs of 15 countries in Africa, Asia, and Central America. Throw-away cans require three times as much energy as returnable bottles to make, use, and dispose of.

5. Does the use of the product damage the environment?

> FOR POP CANS: The actual "use" of the can does not.

6. Does the disposal of the product after use pose a problem for the environment?

> FOR POP CANS: This is one of the biggest problems with pop cans. Although it is becoming economical to recycle the metals in pop cans, most will be thrown away.
>
> Americans consume over 380 soft drinks per person per year. About 65% of these come in non-returnable cans and bottles. That means that millions of cans will end up either as litter in the environment or as solid waste in a landfill or other garbage dumps.

Pop Can Assessment Summary

A summary of the pop can assessment might appear as follows:

Question	Cost Assessment of Pop Cans
1	High
2	High
3	High
4	Very High
5	None
6	Very High
Total Assessment	High

Total Assessment Decision: The pop can represents a high cost to the environment.

Assessing Product Need

Even when an environmental cost assessment has been made for a product, a consumer decision cannot be made until the NEED for the product has been determined. Below are three guidelines for assessing product NEED. After you have read and thought about them, apply these guidelines to determine your need for pop cans.

Guidelines for Assessing Product Need

1. Does the product serve a real need? An imagined need?

2. Are there environmentally desirable (or at least less damaging) substitutes available?

3. Do you value the benefits of the product greater than the costs to the environment?

Assessing the Need for the Pop Can. Answer each of the above questions with respect to your personal need for the pop can. Some space has been provided for your reasoning.

Question 1: Does it serve a real need? ________. An imagined need? ________________. Reasoning: ______________________________________

Question 2: Environmentally desirable substitute available? ____________
Reasoning: ____

Question 3: Do you value the benefits of the product greater than the cost to the environment? ________________. Reasoning: ________________

How do your responses compare to those of your classmates? Do your responses reflect your values in any way? Your classmates? How?

Possible Actions

Identify 3 actions (behaviors) which you feel you should consider and evaluate as a result of the pop can assessment.

1.

2.

3.

Applying Your Skills

Now that you have completed the product need and environmental cost assessment of pop cans, choose a product which you regularly consume (use) and apply the criteria to that product. (Note: student materials should include forms with stated criteria and spaces for writing out findings. Space does not permit the inclusion of a complete work sheet here).

End of Student Materials

Evaluation:

Objectives 1, 2 and 4 may be evaluated as part of a written or oral examination. Objectives 3 through 6 however, are higher level objectives and may be more accurately assessed by evaluating students' work on the unit. Criteria for determining level of achievement may include the following.

1. Has the student thoroughly and accurately researched available sources for information?

2. Has the knowledge been objectively applied to the product cost assessment?

3. Has the student made sufficient attempts to understand his/her own feelings with regard to product need?

4. Are the identified actions consistent with the student's reported assessment findings?

Continued . . .

Sample IV - Ages 16-Adult

Identifying Environmental Action Criteria

Curriculum Goals - Level IV
Environmental Action Skills Level

Goal: . . . develop . . . skills which will permit them to . . . take . . . action . . . (Part A).

Ages: 16 to adults.

Content Area: Environmental Problems Course , Social Studies, EE methods (tertiary level), and others.

(Note: This activity may be equally appropriate at secondary or tertiary levels of education. Its effective use will require that receivers be somewhat prepared in Goal Levels I, II, and III. It should be an appropriate activity for training EE teachers not only in environmental action content, but in a group problem-solving methodology as well.)

Instructional Objectives:

Upon or during completion of the activity to identify environmental action criteria, students will be expected to be able to . . .

1. . . . effectively participate in and/or organize a small group creative problem solving activity.

2. . . . describe in writing the processes and key guidelines to be used in the problem solving approach modeled, and critique the technique as a problem solving process.

3. . . . describe in writing, the criteria for selecting environmental actions and discuss the benefits, limitations (constraints) and procedures for applying each criterion.

> (Note: These objectives are not exhaustive for this activity. Depending on the age group and context in which this is used, other objectives could be written. For example, if the activity was extended to consider the application as well as the creation of the criteria, objectives concerning that task could be added.)

Instructions:

It must be assumed that participants in this activity have been involved in environmental issue investigation and evaluation and are now preparing to consider steps for selecting environmental action. This activity is appropriate since it involves receivers with group decision making processes (an important dimension of environmental problem solving) as well as with the criteria for selecting environmental actions. One advantage of the process is that it provides opportunity for each group member to participate. The product of the group is improved because it reflects the thinking of all members. The process is also more efficient since it provides an orderly, structured approach to group decision making.

The process requires that participants be divided into problem-solving groups of 5-9 individuals each. One member becomes a recorder and another directs the group through the various steps. Each group will need a felt pen, large newsprint pad on a free-standing easel, and masking tape. Before breaking into groups, the instructor should carefully describe the steps and rules of the process to all members. It will be necessary to have these posted (or distributed on paper) so each person can refer to them periodically. Once the process has been explained, allow the groups to proceed, with the instructor free to insure that necessary steps are being followed. The steps and guidelines for the process are described below (this may be duplicated and distributed to groups).

Problem Solving Group Activity

POSTING PHASE[1]

PURPOSE: To allow each individual in the group to identify criteria of particular concern to him. The product of this phase is a complete list of criteria to be used in selecting environmental actions.

GUIDELINES FOR THE GROUP LEADER

1. State purpose and product of this phase to the group.

2. Write the stimulus statement on a blackboard or easel so the entire group can see it. The stimulus statement for this project is:

   WHAT CRITERIA SHOULD BE CONSIDERED WHEN EVALUATING POTENTIAL ENVIRONMENTAL ACTIONS FOR SELECTION AND IMPLEMENTATION?

3. Read directions to the group:

   a) Look at the stimulus statement.
   b) List privately on a piece of paper as many answers to the statements as you can think of.
   c) In round-robin order, tell the group leader one of the items you have written down. He will continue around the group in order until all items have been posted.

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[1] Adapted from materials describing a more complete decision making process, developed by the Agriculture and Natural Resources Education Institute, Michigan State Univerisity, 1978.

 d) Recorder will post each item so all can see it, and tape pages to wall as the pages fill up.
 e) It is OK to add new items to your list while we are posting.
 f) It is OK to ask for clarification of a listed item.
 g) It is NOT OK to criticize or evaluate posted items at this time.

4. After each group member has stated an issue, the recorder will summarize it in abbreviated form and check with the group regarding the accuracy of the summarized issue.

5. Help the recorder post the summarized criterion so all can see it.

6. After posting each criterion, ask if clarification is needed.

7. To any comments that are not clarification (e.g., criticism or evaluation) reply: "That's good comment, we will deal with that in the problem solving phase."

8. Continue around the group until group members have exhausted their lists and all criteria are posted.

CONSOLIDATION PHASE

PURPOSE: To identify criteria that are related. The product of this phase is a consolidated list.

GUIDELINES FOR THE GROUP LEADER

1. State purpose and product of this phase to the group.

2. Read directions to the group:

    a) Look at the list of posted criteria and identify those that seem similar or are parts of a larger criterion.
    b) Eliminate those that are redundant or restate the criteria in a consolidated form.

3. Allow time for thinking.

4. Group should agree on all suggestions for eliminating or consolidating criteria. This process may require some discussion. If entire group does not agree, retain both old and new items.

5. Summarize new consolidated criteria. Before posting; check accuracy with the group and post on blackboard or posting paper.

6. Continue to ask these questions:

    a) Are there any redundancies?
    b) Are there any criteria which appear to be a part of a larger criterion?

7. After posting a consolidated criterion,cross out the items it subsumes.

8. Continue process until group is satisfied with the list.

Once the problem solving groups have refined their lists of criteria, the lists should be shared and discussed by the entire group. The goal is for the entire group to agree on a list of criteria which they feel could be effectively applied in selecting environmental actions. A list of such criteria are provided below for reference.[1] Criteria developed by the groups should be cross checked with this list to make the finished product as complete as possible.

Criteria for Environmental Action Selection

1. Is there sufficient evidence to warrant action on this issue?
2. Are there alternative actions available for use?
3. Is the action chosen the most effective one available?
4. Are there legal consequences of this action?
5. Will there be social consequences of this action?
6. Will there be economic consequences of this action?
7. Do my personal values support this action?
8. Do I understand the procedures necessary to take this action?
9. Do I have the skills needed to take this action?
10. Do I have the courage to take this action?
11. Do I have the time needed to complete this action?
12. Do I have all of the other resources needed to make this action effective?
13. What are the ecological consequences of this action?

This activity should be followed by a consideration of how to implement the criteria and constraints in their use. It would be advisable to provide a model environmental issue which illustrates the application of the criteria. This should be followed by an opportunity for receivers to apply the criteria to potential environmental actions of their own choosing.

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[1] Adapted from Hungerford, H. R. and Peyton, R. B. Teaching Environmental Education. Portland, Maine, J. W. Walch Publishing Company, 1976.

Evaluation:

The objectives of this activity are in part measured by the extent of student participation in the activity. Objectives may also be evaluated by means such as those discribed below.

1. Have receivers write a summary of the group process, describing the key steps, guidelines for implementation, and discuss the effectiveness of the method.

2. Present receivers with an assortment of situations requiring group decision making and ask them to select those situations for which the process is appropriate and defend their selection. Further, they should prepare the stimulus statement.

3. Require students to organize and implement group sessions to determine constraints which impinge on all or some of the criteria generated.

4. Ask students to describe in writing, a list of criteria for selecting environmental actions and to discuss the benefits, constraints and procedures for applying the criteria.

APPENDIX - B

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